SOIL SURVEY OF

Crawford County, Indiana

United States Department of Agriculture
Soil Conservation Service and Forest Service
in cooperation with
Purdue University
Agricultural Experiment Station

Major fieldwork for this soil survey was done in the period 1964-69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Crawford County Soil and Water Conservation District.

Copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied to managing farms and woodland; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Crawford County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification and woodland grouping for each soil. It also shows the page where each soil is described and the page for the capability unit in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the woodland suitability groups.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped, in tabular form, according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Crawford County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They will also be interested in the information about the county given in the section "General Nature of the County."

Cover picture: Typical landscape in the Wellston-Gilpin-Zanesville-Berks association.

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SOIL SURVEY OF CRAWFORD COUNTY, INDIANA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH PURDUE UNIVERSITYAGRICULTURE EXPERIMENT STATION

CRAWFORD COUNTY is in the extreme south-central part of Indiana (fig. 1.) It has an area of 199,680 acres. English is the county seat.

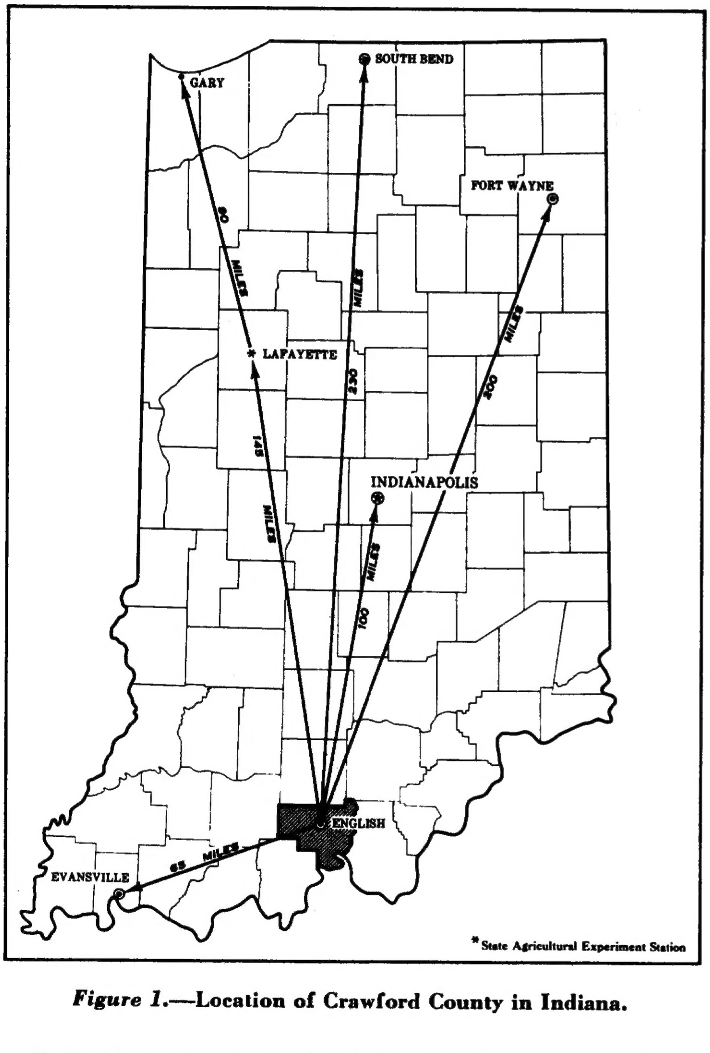

Figure 1.—Location of Crawford County in Indiana.

Soils throughout much of the county are on uplands and are strongly sloping to very steep. Those on terraces along the Ohio River and its major tributaries are nearly level and gently sloping. In many places steep escarpments separate the soils on terraces from those on bottom lands. Many areas of soils on bottom lands, including those along the Ohio River, are subject to flooding.

Most of the acreage is in trees or is used for permanent pasture. A small part of the acreage, mainly on bottom lands, terraces, and broad ridgetops, is used for cultivated crops. Most farms in the county are general farms. Livestock and livestock products are the major sources of farm income.

How This Survey was Made

Soil scientists made this survey to learn what kinds of soil are in Crawford County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Wellston and Zanesville, for example, are the names of two soil series. All the soils in the United States having the same series

names are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Wellston silt loam, 12 to 18 percent slopes, eroded, is one of several phases within the Wellston series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit, the soil complex, is shown on the soil map of Crawford County.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Berks-Gilpin-Weikert complex, 25 to 75 percent slopes, is an example.

In most areas surveyed, there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Crawford County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The general soil map of Crawford County and that of Harrison County, to the east, do not join precisely. This inconsistency is attributed to slight differences in soil patterns on either side of the Blue River, the common boundary of these counties.

The soil associations in Crawford County are discussed in the following pages.

1. Haymond-Wakeland association

Nearly level, deep, well-drained and somewhat poorly drained, medium-textured soils on bottom lands

This association is adjacent to streams. The soils formed in mixed alluvium from adjacent uplands. The association occupies about 1 percent of the county. It is about 85 percent Haymond soils, 10 percent Wakeland soils, and 5 percent minor soils.

Haymond soils are well drained. They have a surface layer of dark grayish-brown silt loam and a subsoil of dark-brown silt loam.

Wakeland soils are somewhat poorly drained. They have a surface layer of dark grayish-brown silt loam and a subsoil of grayish-brown silt loam mottled with pale brown.

Minor soils are mainly in the Elkinsville and Pekin

series. They are on terraces adjacent to streams. Elkinsville soils are well drained and are gently sloping and moderately sloping. Pekin soils are moderately well drained, are gently sloping, and have a very slowly permeable fragipan.

This association is suited to field crops and pasture. It is used mainly for corn, soybeans, and meadow. Flooding is a hazard during periods of intensive runoff from adjacent uplands. Wheat and some meadow crops are subject to severe damage during long periods of flooding.

2. *Tilsit-Johnsburg association*

Nearly level and gently sloping, deep, moderately well drained and somewhat poorly drained, medium-textured soils that have a brittle, very slowly permeable subsoil; on uplands

The soils in this association formed in loess, or windblown silt, and in material weathered from sandstone, siltstone, and shale. A firm, brittle, and very slowly permeable fragipan is at a depth of about 24 inches. This association occupies about 7 percent of the county. It is about 50 percent Tilsit soils, 35 percent Johnsburg soils, and 15 percent minor soils.

Tilsit soils are on ridgetops, on the sides of broad ridges, and in areas along drainageways. They are moderately well drained and nearly level or gently sloping. The surface layer of Tilsit soils is dark-brown silt loam, and the subsoil is yellowish-brown and gray silt loam and silty clay loam. Many yellowish-brown mottles are in the subsoil.

Johnsburg soils are on broad ridgetops. They are somewhat poorly drained and nearly level. The surface layer of Johnsburg soils is dark grayish-brown silt loam, and the subsoil is silt loam and silty clay loam. The upper part of their subsoil is mostly pale brown, and the lower part is yellowish brown and is mottled with gray and yellowish brown.

Minor soils are mainly in the Zanesville and Wellston series. Zanesville soils are on side slopes below ridgetops. They are well drained, are moderately sloping, and have a very slowly permeable fragipan. Wellston soils are well drained, are moderately sloping or strongly sloping, and are underlain by bedrock at a depth of 40 to 60 inches.

This association is used for field crops and pasture. The main crops are corn, soybeans, small grain, and meadow. Wetness limits use of the soils where slopes are less than 2 percent. Susceptibility to erosion limits use of the soils where slopes are greater than 2 percent. Soils that have a fragipan have a limited root zone and are somewhat droughty during long dry periods in summer.

3. *Hagerstown-Crider association*

Gently sloping to steep, deep, well-drained, medium-textured and moderately fine textured soils on uplands

This association is on the tops and sides of ridges. The soils formed in loess and in material weathered from limestone bedrock (fig. 2). The association occupies about 6 percent of the county. It is about 65 percent Hagerstown soils, 20 percent Crider soils, and 15 percent minor soils.

Hagerstown soils are on side slopes below ridgetops and are moderately sloping to steep. They have a surface layer of dark-brown silt loam and silty clay loam and a subsoil of red silty loam to clay.

Crider soils are mainly on ridgetops and are gently sloping and moderately sloping. They have a surface layer of brown silt loam. Their subsoil is strong-brown silt loam in the upper part and yellowish-red and red silty clay loam to clay in the lower part.

Minor soils are mainly in the Corydon, Wellston, and Haymond series. Corydon soils are steep or very steep and are underlain by limestone bedrock at a depth of 10 to 20 inches. Wellston soils are moderately sloping and strongly sloping and are underlain by sandstone bedrock at a depth of 36 to 60 inches. Haymond soils are nearly level and deep. They formed in alluvial deposits along streams and are subject to flooding.

This association is used for field crops and pasture. It is mainly in corn, soybeans, small grain, and meadow. Runoff and susceptibility to erosion are the major limitations.

4. *Wellston-Gilpin-Zanesville-Berks association*

Moderately sloping to very steep, moderately deep and deep, well-drained, medium-textured soils on uplands

This association is on ridgetops and long and short side slopes. The soils formed mainly in material weathered from sandstone, siltstone, and shale, but in places they formed partly in a thin mantle of loess (fig. 3). The association occupies about 85 percent of the county. It is about 40 percent Wellston soils, 25 percent Gilpin soils, 15 percent Zanesville soils, 10 percent Berks soils, and 10 percent minor soils.

Wellston soils are on ridgetops and side slopes. They are moderately sloping or strongly sloping and are moderately deep and deep. They have a surface layer of brown and dark grayish-brown silt loam. Their subsoil is strong-brown and yellowish-brown silt loam and silty clay loam, and it has many coarse fragments in the lower part. Bedrock is at a depth of 36 to 60 inches.

Gilpin soils are below the ridgetops. They are steep and moderately deep. They have a surface layer of dark grayish-brown silt loam and a subsoil of yellowish-brown and strong-brown silt loam and silty clay loam. In most places less than 20 percent of the subsoil is coarse fragments. Bedrock is at a depth of 20 to 36 inches.

Zanesville soils are on ridgetops and on side slopes below ridgetops. They are moderately sloping and deep. They have a surface layer of dark-brown silt loam and a subsoil of strong-brown and yellowish-brown silt loam and silty clay loam. A brittle, very slowly permeable fragipan is at a depth of about 24 inches.

Berks soils are on long and short breaks below ridgetops. They are steep and very steep and are moderately deep. They have a surface layer of dark grayish-brown and brown silt loam. Their subsoil is yellowish-brown silt loam that is 20 to 60 percent channery fragments. Bedrock is at a depth of 20 to 36 inches.

Minor soils are mainly in the Tilsit and Haymond series. Tilsit soils are on ridgetops. They are nearly level and gently sloping, deep, and moderately well drained. Tilsit soils have a brittle, very slowly permeable fragi-

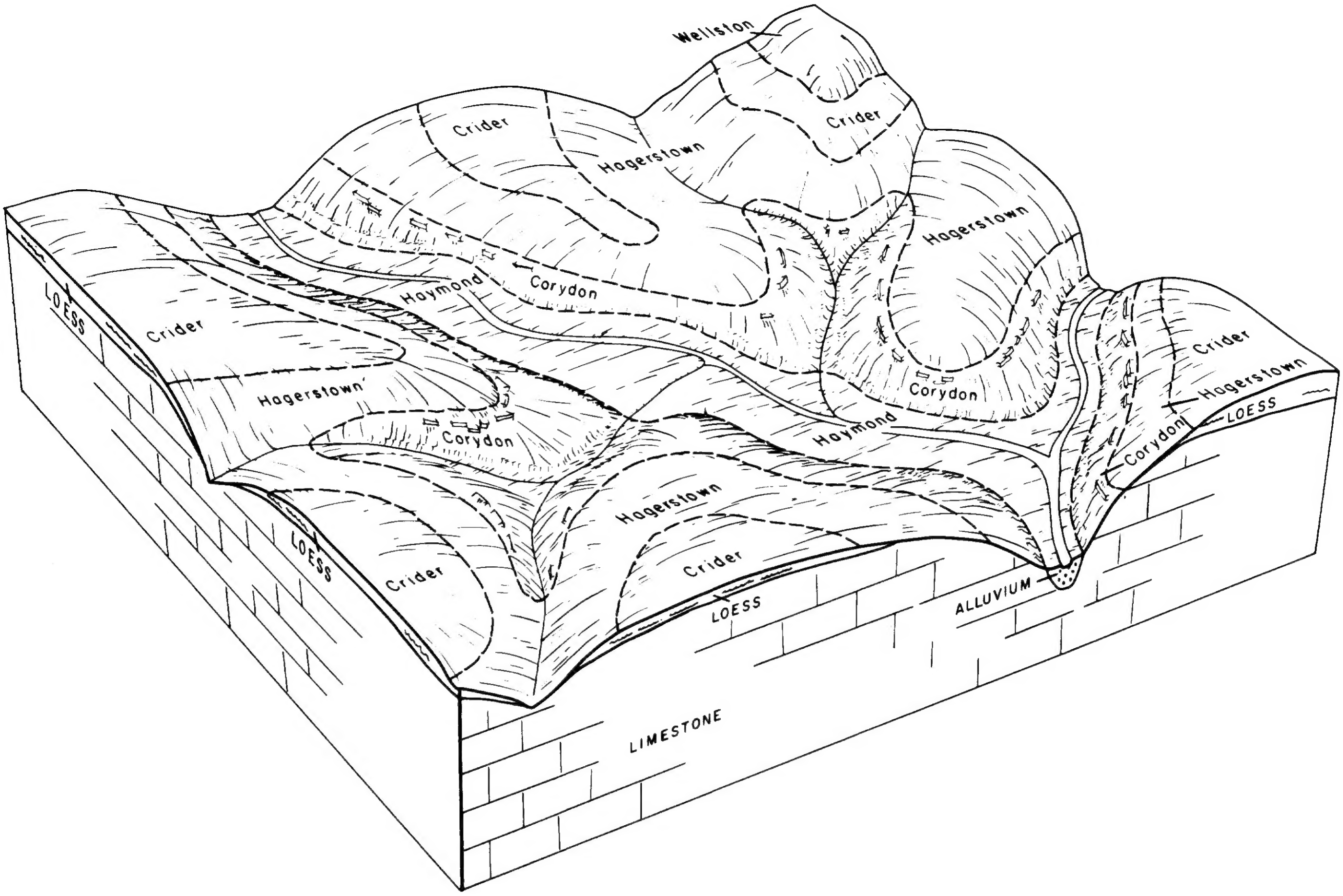

***Figure 2.*—Pattern of soils and underlying material in the Hagerstown-Crider association.**

pan at a depth of about 24 inches. Haymond soils are along streams and are subject to flooding. They formed in alluvium and are deep and nearly level.

This association is used mainly for field crops, pasture, and trees. The main crops are corn, soybeans, small grain, and meadow, but the production of timber is also important. Runoff and susceptibility to erosion affect use and management of the soils. Bedrock or a fragipan limits the depth to which roots can penetrate and the available water capacity of the soils.

5. *Markland-Wheeling-Huntington association*

Nearly level to very steep, deep, well-drained, medium textured and moderately fine textured soils on terraces and bottom lands.

This association is on terraces and bottom lands. The soils formed in lacustrine and alluvial material. The association occupies about 1 percent of the county. It is about 30 percent Markland soils, 25 percent Wheeling soils, 20 percent Huntington soils, and 25 percent minor soils.

Markland soils are on terraces above flood plains. They are well drained and are moderately sloping to very steep. They have a surface layer of dark grayish-brown silt loam and silty clay loam and a subsoil of yellowish-brown silty clay loam and silty clay.

Wheeling soils are on terraces above flood plains. They are well drained and are nearly level to steep. They have a surface layer of dark-brown loam and a subsoil of yellowish-brown and dark yellowish-brown silty clay loam and silt loam.

Huntington soils are on bottom lands along the Ohio River. They are well drained and are nearly level. They have a surface layer of very dark grayish-brown silt loam and a subsoil of dark-brown and brown silt loam. Huntington soils are subject to flooding.

Minor soils are mainly in the Alford and Henshaw series. Alford soils are on uplands and terraces. They are well drained and are gently sloping to steep. Henshaw soils occupy broad flats on terraces. They are somewhat poorly drained and are nearly level and gently sloping.

This association is well suited to field crops and pasture. It is used mainly for corn, soybeans, small grain, and meadow. If properly managed, most areas are well suited to intensive use for row crops. The soils that have slopes greater than 2 percent, however, are subject to runoff and erosion, and these limitations affect

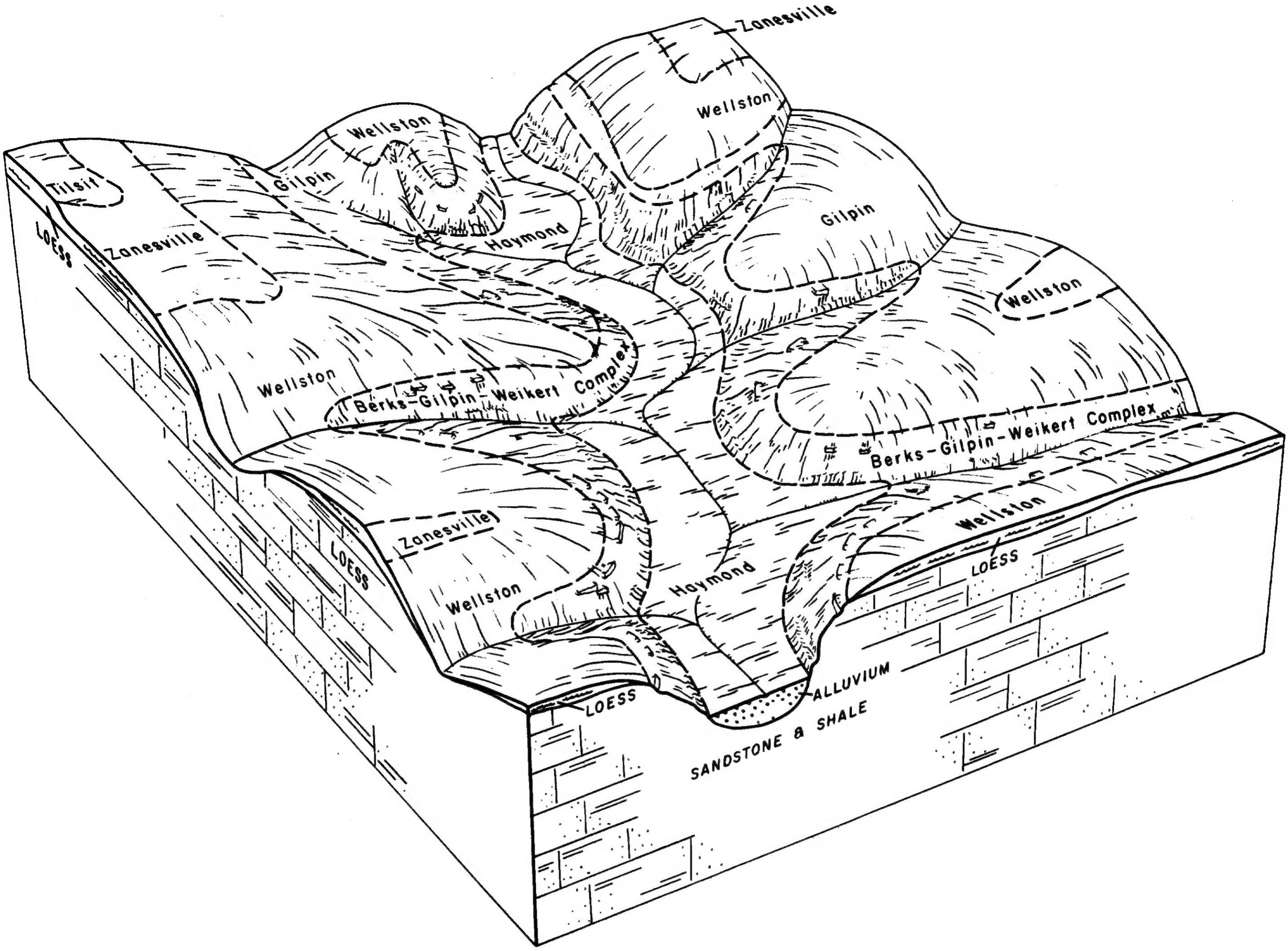

Figure 3.—**Pattern of soils and underlying material in the Wellston-Gilpin-Zanesville-Berks association.**

their use and management. Crops grown on the soils that are subject to flooding are likely to be damaged during flooding. Wetness limits use of the Henshaw soils for crops.

Descriptions of the Soils

This section describes the soil series and mapping units in Crawford County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gullied land, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland suitability group in which the mapping unit

has been placed. The page for the description of each capability unit can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*7*).[1]

Alford Series

The Alford series consists of deep, well-drained, gently sloping to steep soils on uplands and terraces. These soils formed in loess. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark yellowish-brown silt loam about 4 inches thick. The subsurface layer is dark yellowish-brown and strong-brown, friable silt loam about 3 inches thick. The subsoil is friable, strong-brown light silty clay loam and silt loam about 43 inches thick. The underlying material is mainly strong-brown silt loam, but it contains thin layers of very fine sand.

The content of organic matter is low. Available water capacity is high, and permeability is moderate. Runoff is slow in the gently sloping areas and is rapid or very rapid in the strongly sloping to steep areas. The surface layer is medium acid in areas that have not been limed.

Alford soils are suited to most crops commonly grown in the county, but runoff and susceptibility to erosion limit their use and affect their management. Crops respond well to lime and fertilizer.

[1] Italic numbers in parentheses refer to Literature Cited, p. 59.

Representative profile of Alford silt loam, 12 to 25 percent slopes, eroded, in a south-facing sod field; 790 feet south and 400 feet east of the northwest corner of SE¼ sec. 33, T. 4 S., R. 1 E.:

Ap—0 to 4 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A&B—4 to 7 inches, dark yellowish-brown (10YR 4/4) and strong-brown (7.5YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable; slightly acid; clear, wavy boundary.

B2t—7 to 40 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; dark-brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear, wavy boundary.

B3—40 to 50 inches, strong-brown (7.5YR 5/6) silt loam; weak, coarse, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

C—50 to 80 inches, strong-brown (7.5YR 5/6) silt loam; massive; friable; some thin strata of very fine sand; medium acid.

The Ap horizon ranges from dark grayish brown to dark yellowish brown. The B horizon is silt loam to silty clay loam and ranges from yellowish brown to dark brown or strong brown. The mantle of loess is 5 to 10 feet thick over limestone, sandstone, or shale.

Alford soils are similar to Wellston soils. They are deeper over bedrock than Wellston soils, and they formed entirely in loess, whereas Wellston soils formed partly in material weathered from sandstone, siltstone, and shale.

Alford silt loam, 2 to 6 percent slopes, eroded (AfB2). This soil is on benches adjacent to drainageways. Runoff is slow.

Included with this soil in mapping were small areas of soils that have a surface layer of loam or fine sandy

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Alford silt loam, 2 to 6 percent slopes, eroded	404	0.2
Alford silt loam, 12 to 25 percent slopes, eroded	104	.1
Bartle silt loam	300	.2
Berks-Gilpin-Weikert complex, 25 to 75 percent slopes	37,222	18.6
Burnside silt loam	1,855	.9
Corydon stony silt loam, 20 to 60 percent slopes	2,050	1.0
Crider silt loam, 2 to 6 percent slopes, eroded	199	.1
Crider silt loam, 6 to 12 percent slopes, eroded	1,846	.9
Cuba silt loam	570	.3
Elkinsville silt loam, 2 to 6 percent slopes, eroded	653	.3
Elkinsville silt loam, 6 to 12 percent slopes, eroded	349	.2
Gilpin silt loam, 18 to 25 percent slopes, eroded	13,614	6.8
Gilpin silt loam, 18 to 25 percent slopes, severely eroded	4,769	2.4
Gilpin-Berks complex, 18 to 30 percent slopes	9,336	4.7
Gullied land	945	.5
Hagerstown silt loam, 12 to 18 percent slopes, eroded	561	.3
Hagerstown silt loam, 18 to 25 percent slopes, eroded	754	.4
Hagerstown silty clay loam, 6 to 12 percent slopes, severely eroded	2,683	1.3
Hagerstown silty clay loam, 12 to 18 percent slopes, severely eroded	4,824	2.4
Haymond silt loam	8,079	4.1
Henshaw silt loam, 0 to 3 percent slopes	260	.1
Huntington silt loam	653	.3
Johnsburg silt loam	2,070	1.0
Markland silt loam, 12 to 18 percent slopes, eroded	123	0.1
Markland silt loam, 25 to 70 percent slopes	361	.2
Markland silty clay loam, 6 to 12 percent slopes, severely eroded	243	.1
Markland silty clay loam, 12 to 18 percent slopes, severely eroded	210	.1
Pekin silt loam, 2 to 6 percent slopes	490	.2
Quarries	505	.3
Tilsit silt loam, 0 to 2 percent slopes	1,992	1.0
Tilsit silt loam, 2 to 6 percent slopes, eroded	15,694	7.9
Wakeland silt loam	833	.4
Wellston silt loam, 6 to 12 percent slopes, eroded	1,402	.7
Wellston silt loam, 6 to 12 percent slopes, severely eroded	6,774	3.4
Wellston silt loam, 12 to 18 percent slopes, eroded	15,001	7.5
Wellston silt loam, 12 to 18 percent slopes, severely eroded	38,405	19.2
Wheeling loam, 0 to 2 percent slopes	182	.1
Wheeling loam, 2 to 6 percent slopes, eroded	249	.1
Wheeling loam, 6 to 12 percent slopes, eroded	176	.1
Wheeling loam, 12 to 25 percent slopes, eroded	190	.1
Zanesville silt loam, 6 to 12 percent slopes, eroded	7,244	3.6
Zanesville silt loam, 6 to 12 percent slopes, severely eroded	15,106	7.6
Water	400	.2
Total	199,680	100.0

loam and are underlain by stratified silt and fine sand. These areas are indicated on the soil map by the spot symbol for sand. Also included were small areas of Henshaw and Markland soils and small areas of soils that are mottled at a depth of about 18 inches.

This Alford soil is suited to most crops commonly grown in the county, but runoff and susceptibility to further erosion affect its use and management. The major crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIe–3; woodland suitability group 1o1.

Alford silt loam, 12 to 25 percent slopes, eroded (AfE2). This soil is below ridges. It has the profile described as representative of the series. Runoff is rapid or very rapid.

Included with this soil in mapping were small areas of soils that have a surface layer of loam or fine sandy loam and are underlain by stratified silt and fine sand. These areas are indicated on the soil map by the spot symbol for sand. Also included were small areas of severely eroded soils and small areas of soils that have slopes steeper than 25 percent or less than 12 percent.

This Alford soil is suited to hay and pasture. Runoff and susceptibility to further erosion affect its use and management. Crops respond well to lime and fertilizer. Capability unit VIe–1; woodland suitability group 1o1.

Bartle Series

The Bartle series consists of deep, somewhat poorly drained, nearly level soils that have a very firm and brittle fragipan at a depth of about 32 inches. These soils are on alluvial terraces adjacent to streams. They formed in stratified silt and fine sand. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is about 9 inches thick and is yellowish-brown silt loam mottled with pale brown. The subsoil is about 63 inches thick. The upper 11 inches of the subsoil is friable, light-gray silt loam mottled with pale brown, light yellowish brown, brownish yellow, and yellowish brown; the next 12 inches is friable, light yellowish-brown and light-gray silt loam mottled with light gray, light yellowish brown, and yellowish brown; and the lower 40 inches is a very firm and brittle fragipan of light-gray and light brownish-gray heavy silt loam and silty clay loam mottled with light yellowish brown, yellowish brown, and strong brown. The underlying material is yellowish-brown silt loam mottled with light brownish gray.

The content of organic matter is low. Available water capacity is moderate, and permeability is very slow. Runoff is also very slow. The surface layer is strongly acid in areas that have not been limed.

Wetness is the major limitation that affects the use and management of Bartle soils, but frost-heave potential is also high. If properly drained, however, these soils are suited to most crops commonly grown in the county. They are not suited to deep-rooted legumes, because the fragipan restricts the depth to which roots can penetrate. Crops grown on these soils respond well to lime and fertilizer.

Representative profile of Bartle silt loam in a sod field, 1,320 feet east and 330 feet north of the southwest corner of sec. 19, T. 3 S., R. 1 E.:

Ap—0 to 9 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, faint, pale-brown (10YR 6/3) mottles; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B1g—9 to 12 inches, light-gray (10YR 7/2) silt loam; many, medium, distinct, pale-brown (10YR 6/3), light yellowish-brown (10YR 6/4), and brownish-yellow (10YR 6/6) mottles; moderate, medium, subangular blocky structure; friable; few iron and manganese concretions; very strongly acid; clear, wavy boundary.

B21tg—12 to 20 inches, light-gray (10YR 7/2) silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; pale-brown (10YR 6/3) clay films on faces of peds; few iron and manganese concretions; very strongly acid; clear, wavy boundary.

B22tg—20 to 27 inches, light yellowish-brown (10YR 6/4) silt loam; common, medium, distinct, light-gray (10YR 7/2) mottles; moderate, medium, subangular blocky structure; friable; yellowish-brown (10YR 5/4) silt loam in old root channels; thin discontinuous clay films on faces of peds; few iron and manganese concretions; very strongly acid; clear, wavy boundary.

B23tg—27 to 32 inches, light-gray (10YR 7/2) silt loam; many, medium, distinct, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few iron and manganese concretions; very strongly acid; clear, wavy boundary.

Bx1g—32 to 40 inches, light-gray (10YR 7/2) heavy silt loam; many, medium, distinct, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles; weak, very coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm and brittle; thin clay films on faces of peds; few iron and manganese concretions; very strongly acid; clear, wavy boundary.

Bx2g—40 to 72 inches, light brownish-gray (10YR 6/2) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; strong, very coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm and brittle; many clay films on faces of peds; common iron and manganese concretions; very strongly acid; clear, wavy boundary.

C—72 to 87 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, distinct, light brownish-gray (10YR 6/2) mottles; massive; friable; numerous clay flows down old root channels; common iron and manganese concretions; very strongly acid.

The Ap horizon ranges from dark grayish brown to yellowish brown. The B horizon ranges from light gray to light yellowish brown or light brownish gray and is silt loam to silty clay loam. Depth to the fragipan ranges from 24 to 36 inches. The C horizon is at a depth of 40 to 75 inches. Its texture generally ranges from silt loam to silty clay loam, but there are some thin layers of fine sand and clay.

Bartle soils are similar to Johnsburg soils. They are underlain by stratified material, whereas Johnsburg soils are underlain by sandstone or shale.

Bartle silt loam (0 to 2 percent slopes) (Ba).—This soil is on alluvial terraces along streams. Runoff is very slow.

Included with this soil in mapping were small areas of light-gray soils that are poorly drained. Also included were small areas of Pekin soils, which are moderately well drained.

Wetness is the major limitation that affects the use and management of this soil. The very slowly permeable fragipan restricts the downward movement of water and the penetration of roots. Nevertheless, if this soil is properly drained, it is suited to most crops commonly

grown in the county. It is not well suited to deep-rooted legumes, because the roots of those plants cannot penetrate the fragipan. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIw–3; woodland suitability group 3w5.

Berks Series

The Berks series consists of moderately deep, well-drained, steep and very steep soils on uplands throughout the county. These soils formed in material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is very dark grayish-brown channery silt loam about 3 inches thick. The subsurface layer is friable, brown channery silt loam about 5 inches thick. The subsoil is friable, yellowish-brown very channery silt loam about 16 inches thick. Cemented sandstone bedrock underlies the subsoil.

The content of organic matter and available water capacity are low, and permeability is moderate. Runoff is very rapid. In areas that have not been limed, the surface layer is strongly acid.

Berks soils are well suited to trees and to use for recreation. Runoff and susceptibility to erosion are the major limitations.

Representative profile of Berks channery silt loam from a wooded area of Berks-Gilpin-Weikert complex, 25 to 75 percent slopes, where the slope is 28 percent and faces east; 1,188 feet south and 924 feet west of the northeast corner of sec. 10, T. 3 S., R. 2 E.:

O1—½ inch to 0, partly decomposed hardwood leaf litter.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) channery silt loam; moderate, medium, granular structure; friable; slightly acid; abrupt, wavy boundary.

A2—3 to 8 inches, brown (10YR 4/3) channery silt loam; moderate, medium, granular structure; friable; very strongly acid; clear, wavy boundary.

B2—8 to 24 inches, yellowish-brown (10YR 5/6) very channery silt loam; moderate, medium, subangular blocky structure; friable; 60 percent, by volume, is fragments of sandstone; very strongly acid; clear, wavy boundary.

R—24 inches, hard sandstone bedrock.

The A1 horizon is very dark grayish brown or dark grayish brown and ranges from 1 to 5 inches in thickness. The A2 horizon is brown to light yellowish brown and ranges from 1 to 7 inches in thickness. In places as much as 50 percent of the A horizon is channery fragments. The B horizon is dark yellowish brown or yellowish brown to strong brown and ranges from 16 to 30 inches in thickness. The content of channery fragments in the B horizon ranges from 35 to 60 percent.

Berks soils are similar to Gilpin and Weikert soils. They have a coarser textured B horizon than Gilpin soils. They are deeper over bedrock than Weikert soils.

Berks-Gilpin-Weikert complex, 25 to 75 percent slopes (BgF).—Soils of this mapping unit are on uplands. Some areas, consisting mainly of very steep Berks and Weikert soils, are on bluffs along the Ohio River. Sandstone, limestone, and shale crop out throughout areas of this mapping unit. About 30 percent of the acreage is Berks channery silt loam, 30 percent is Gilpin silt loam, and 25 percent is Weikert channery silt loam. About 15 percent is soils that were included in mapping.

The Berks soil is mainly between benches, or shelflike areas, on hillsides. On long hillsides it is also in areas near the base of escarpmentlike slopes. Some areas are at the lower end of natural drainageways. Slopes are mostly between 25 and 45 percent.

The Gilpin soil is mainly on benches and in slump areas on hillsides, but it is also in areas between natural drainageways. Slopes range from 25 to 35 percent.

The Weikert soil is mainly in areas where some bedrock is exposed, mostly on benches, or shelflike areas. The benches are not continuous but occur in a fairly consistent pattern at irregular elevations on the slopes. This soil is also on abrupt escarpments immediately below the benches. Slopes range from 25 to 75 percent. This soil has the profile described as representative of the Weikert series.

Included with these soils in mapping were small areas of Wellston soils on narrow benches; small areas of fine-textured soils that are shallow over clay shale; and small areas of moderately coarse textured soils that are shallow or moderately deep over weathered sandstone. Also included were small areas of Hagerstown and Corydon soils; small areas of deep colluvial soils that contain many fragments of rock and are at the base of slopes; areas where slopes are less than 25 percent; and small cleared areas where a moderate amount of soil material from the surface layer has been removed by erosion.

Soils of this mapping unit are suited to selected kinds of hardwoods. Runoff and susceptibility to erosion are the major limitations, but these soils are also shallow, stony, and steep. Capability unit VIIe–2; woodland suitability group 3r12.

Burnside Series

The Burnside series consists of deep, well-drained, nearly level soils on flood plains throughout the county. These soils formed in silty alluvium that is medium acid to neutral. The alluvium was derived mainly from upland soils that formed in loess and in material weathered from siltstone, sandstone, and shale. It was derived partly from soils that formed in material weathered from limestone. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is about 18 inches thick. The upper 4 inches is friable, dark-brown silt loam; and the lower 14 inches is friable, dark-brown channery silt loam and very channery silt loam. The underlying material is dark-brown very channery loam.

The content of organic matter is moderate. Available water capacity is low or moderate, and permeability is moderate. Runoff is very slow. In most areas that have not been limed, the surface layer is slightly acid or neutral.

Burnside soils are suited to most crops commonly grown in the county, but droughtiness and susceptibility to occasional flooding affect their use and management. Crops respond well to fertilizer.

Representative profile of Burnside silt loam, 650 feet west and 790 feet south of the northeast corner of SW¼ sec. 8, T. 2 S., R. 2 W.:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; slightly acid; clear, smooth boundary.

B1—8 to 12 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, subangular blocky structure parting to moderate, medium, granular; friable; dark grayish-brown (10YR 4/2) silt coats on faces of peds; slightly acid; clear, wavy boundary.

B21—12 to 18 inches, dark-brown (10YR 4/3) channery silt loam; moderate, medium, subangular blocky structure; friable; dark grayish-brown (10YR 4/2) silt coats on faces of peds; about 25 percent, by volume, fragments of sandstone less than 4 inches in length; medium acid; clear, wavy boundary.

B22—18 to 26 inches, dark-brown (10YR 4/3) very channery silt loam; moderate, medium, subangular blocky structure; friable; 50 percent, by volume, fragments of sandstone, mostly less than 4 inches but as much as 9 inches in length; medium acid; gradual, wavy boundary.

C—26 to 60 inches, dark-brown (10YR 4/3) very channery loam; structureless (massive); friable; 50 percent, by volume, fragments of sandstone, mostly less than 4 inches but as much as 9 inches in length; medium acid.

The Ap horizon is silt loam or loam, and it ranges from dark grayish brown to brown or dark brown. The B2 horizon is silt loam or very channery loam and ranges from dark grayish brown to brown or dark brown. The content of channery fragments in the B2 horizon ranges from 20 to 60 percent, but it generally is between 35 and 60 percent at a depth of 10 to 40 inches. Depth to the channery horizons ranges from 10 to 24 inches.

Burnside soils are similar to Haymond soils. They have a large number of channery fragments in the B2 horizon, unlike Haymond soils.

Burnside silt loam (0 to 2 percent slopes) (Bu).—This soil is on flood plains along streams throughout the county. In places the surface layer contains many fragments of rock. Runoff is very slow.

Included with this soil in mapping were a few areas of a gently sloping soil along channels created by floodwaters. Also included were small areas of Haymond silt loam.

This Burnside soil is suited to most crops commonly grown in the county, but stoniness and susceptibility to occasional flooding affect its use and management. In places fragments of rock interfere with normal tillage. The main crops are corn, soybeans, hay, and pasture. Crops respond well to fertilizer. Capability unit IIs-6; woodland suitability group 1o8.

Corydon Series

The Corydon series consists of well-drained, steep and very steep soils that are shallow over bedrock. These soils are on uplands and on some of the sharp breaks throughout the county. They formed in material weathered from limestone. Limestone is at a depth of less than 20 inches, and it has a thin cap of loess in places. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is very dark grayish-brown stony silt loam about 6 inches thick. The subsoil is about 6 inches thick and is friable, dark-brown heavy silty clay loam. The underlying material is limestone bedrock.

The content of organic matter is medium. Available water capacity is very low, and permeability is moderately slow. Runoff is very rapid. The surface layer is neutral in reaction, and these soils do not need lime.

Corydon soils are better suited to trees than to field crops or pasture. Runoff and susceptibility to erosion are the main limitations to their use and management.

Representative profile of Corydon stony silt loam, 20 to 60 percent slopes, in a wooded area where the slope is 50 percent and faces east; 200 feet west and 50 feet north of the southeast corner of NW$\frac{1}{4}$ sec. 35, T. 2 S., R. 2 E.:

01—1 inch to 0, partly decomposed leaf litter.

A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) stony silt loam, dark brown (10YR 3/3) if crushed; moderate or strong, medium; granular structure; friable; many roots; neutral: clear; wavy boundary.

B21t—6 to 10 inches, dark-brown (7.5YR 3/2) heavy silty clay loam, dark brown (10YR 3/3) if crushed; moderate, medium and fine, subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few roots; neutral; clear, wavy boundary.

B22t—10 to 12 inches, dark-brown (7.5YR 4/3) heavy silty clay loam, dark brown (10YR 3/4) if crushed; moderate, medium and fine, subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few roots; neutral; abrupt, irregular boundary.

R—12 inches, limestone bedrock.

The A1 horizon ranges from very dark brown to dark brown or very dark grayish brown. The B2 horizon ranges from dark brown to reddish brown and from silty clay loam to clay. Depth to limestone bedrock ranges from 10 to 20 inches.

Corydon soils are similar to Hagerstown soils. They are darker colored and shallower over bedrock than Hagerstown soils.

Corydon stony silt loam, 20 to 60 percent slopes (CoF). This soil is on side slopes adjacent to drainageways and creeks in the uplands. Runoff is very rapid.

Included with this soil in mapping were small areas of Hagerstown and Berks soils, small cleared areas of soils that are moderately eroded, and small areas of deep colluvial soils on benches and at the base of slopes. Many outcrops and escarpments of limestone were also included.

This Corydon soil is better suited to trees than to field crops or pasture. Runoff and susceptibility to erosion, are the major limitations; but this soil is also stony and shallow over bedrock. Capability unit VIIe-2; woodland suitability group 3d7.

Crider Series

The Crider series consists of deep, well-drained, gently sloping or moderately sloping soils on uplands. These soils formed in a mantle of loess and in underlying material that weathered from limestone. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is brown silt loam about 8 inches thick. The subsoil is about 63 inches thick. The upper 17 inches of the subsoil is friable, strong-brown silt loam and silty clay loam; the middle 7 inches is firm, yellowish-red and red silty clay or clay; and the lower 39 inches is firm, red and strong-brown clay. The underlying material is limestone bedrock.

The content of organic matter is low. Available water capacity is high, and permeability is moderate. Runoff is slow or medium. The surface layer is strongly acid in areas that have not been limed.

Crider soils are suited to most crops commonly grown

in the county, but susceptibility to further erosion affects their use and management. Crops respond well to lime and fertilizer.

Representative profile of Crider silt loam, 2 to 6 percent slopes, eroded, in a sod field where the slope is 3 percent and faces south; 590 feet west and 525 feet south of the northeast corner of SW¼ sec. 10, T. 2 S., R. 2 E.:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.
B1t—8 to 12 inches, strong-brown (7.5YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) clay films; brown (10YR 4/3) krotovinas; neutral; clear, wavy boundary.
B21t—12 to 25 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) clay films; medium acid; clear, wavy boundary.
IIB22t—25 to 32 inches, yellowish-red (5YR 4/6) and red (2.5YR 4/6) silty clay or clay; strong, medium, angular blocky and subangular blocky structure; firm; yellowish-brown (10YR 5/4) clay films on faces of peds; few chert fragments; strongly acid; gradual, wavy boundary.
IIB23t—32 to 58 inches, red (2.5YR 4/6) and strong-brown (7.5YR 5/6) clay; strong, medium, angular blocky structure; firm; yellowish-brown (10YR 5/8) clay films on faces of peds; strongly acid; gradual, wavy boundary.
IIB24t—58 to 71 inches, variegated red (2.5YR 4/6) and strong-brown (7.5YR 5/6) clay; strong, medium, angular blocky structure; firm, clay films on faces of peds; common iron and manganese concretions; strongly acid.
R—71 inches, limestone bedrock.

The Ap horizon ranges from brown to dark yellowish brown. The B2 horizon ranges from brown or strong brown to dark red or yellowish red. It is silt loam and silty clay loam in the upper part but ranges to silty clay or clay in the lower part. Thickness of the layer of loess ranges from 20 to 40 inches. Depth to bedrock ranges from 60 to 120 inches.

Crider soils are similar to Hagerstown soils. They have a thicker mantle of loess and are deeper over bedrock than Hagerstown soils.

Crider silt loam, 2 to 6 percent slopes, eroded (CrB2). This soil is on narrow ridgetops and in areas between sinkholes. It has the profile described as representative of the Crider series. Runoff is slow.

Included with this soil in mapping were small wooded areas where little erosion has taken place and small areas of severely eroded soils.

This Crider soil is suited to most crops commonly grown in the county. Susceptibility to further erosion is the major limitation. The principal crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIe-3; woodland suitability group 1o1.

Crider silt loam, 6 to 12 percent slopes, eroded (CrC2). This soil is along drainageways and in areas around sinkholes. Runoff is medium.

Included with this soil in mapping were small areas of Hagerstown soils and small areas of severely eroded soils. Also included on narrow benches along the Blue River and its tributaries were small areas of soils that are underlain by stratified silt loam and loam instead of by limestone.

This Crider soil is suited to most crops commonly grown in the county. Susceptibility to further erosion is the major limitation. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIIe-3; woodland suitability group 1o1.

Cuba Series

The Cuba series consists of deep, well-drained, nearly level soils on flood plains. These soils formed in strongly acid, silty alluvium washed from upland soils that formed in loess and in material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 10 inches thick. The subsoil is about 20 inches thick and is friable, dark-brown silt loam. The underlying material is mainly dark-brown and yellowish-brown silt loam, but it has thin layers of loam in the lower part.

The content of organic matter is moderate. Available water capacity is high, and permeability is moderate. Runoff is very slow. In most areas that have not been limed, the surface layer is strongly acid.

Cuba soils are suited to most crops commonly grown in the county. Susceptibility to occasional flooding is the major limitation to their use and management. The main crops are corn, soybeans, hay, and pasture. Crops respond well to lime and fertilizer.

Representative profile of Cuba silt loam in a sod field where the slope is less than 1 percent; 990 feet north and 260 feet west of the southeast corner of NW¼ sec. 31, T. 2 S., R. 2 W.:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.
B2—10 to 30 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; some material from the Ap horizon mixed in by worms; strongly acid; gradual, wavy boundary.
C1—30 to 56 inches, dark-brown (10YR 4/3) silt loam; massive; friable; strongly acid; clear, wavy boundary.
C2—56 to 65 inches, yellowish-brown (10YR 5/4), stratified loam and silt loam; massive; friable; strongly acid.

The Ap horizon ranges from dark grayish brown to brown, and the B2 horizon ranges from dark brown to yellowish brown. The C horizon is stratified silt loam, loam, and fine sandy loam.

Cuba soils are similar to Haymond soils. They are more acid and have a higher content of clay than Haymond soils.

Cuba silt loam (0 to 2 percent slopes) (Cu).—This soil is on flood plains adjacent to streams. The areas have been dissected by meandering streams, and they are mostly narrow and have an irregular shape. Runoff is very slow.

Included with this soil in mapping were a few areas of a gently sloping soil along sloughs and streambanks; small areas of soils that have more sand throughout the profile than is typical of Cuba soils; and areas of soils that are underlain by fragments of rock at a depth of about 18 inches. Also included were small areas of soils that have gray mottles at a depth of 18 to 30 inches.

This Cuba soil is suited to most crops commonly grown in the county, but occasional flooding affects its use and management. Crops are likely to be severely damaged during long periods of flooding. The major crops are corn, soybeans, hay, and pasture. Crops

respond well to lime and fertilizer. Capability unit I–2; woodland suitability group 1o8.

Elkinsville Series

The Elkinsville series consists of deep, well-drained, gently sloping and moderately sloping soils on alluvial terraces along streams. These soils formed in stratified silt, clay, and fine sand. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark-brown silt loam about 9 inches thick. The subsoil is about 31 inches thick. The upper 5 inches of the subsoil is friable, dark yellowish-brown silt loam; the middle 16 inches is friable, yellowish-brown heavy silt loam; and the lower 10 inches is friable, yellowish-brown loam mottled with light yellowish brown. The underlying material is stratified yellowish-brown and light brownish-gray loam and clay loam mottled with pale brown, yellowish brown, very dark grayish brown, and strong brown.

The content of organic matter is low. Available water capacity is high, and permeability is moderate. Runoff is slow or medium. In areas that have not been limed, the surface layer is strongly acid.

Elkinsville soils are suited to most crops commonly grown in the county, but runoff and susceptibility to erosion affect their use and management. Crops respond well to lime and fertilizer.

Representative profile of Elkinsville silt loam, 2 to 6 percent slopes, eroded, in a sod field where the slope is 3 percent; 790 feet west and 925 feet north of the southeast corner of NW¼ sec. 1, T. 2 S., R. 1 E.:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B1—9 to 14 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure parting to moderate, medium, granular; friable; dark-brown (10YR 4/3) wormcasts; slightly acid; clear, wavy boundary.

B2t—14 to 30 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; friable; dark-brown (7.5YR 4/4) discontinuous clay films; silt films on faces of peds; very strongly acid; gradual, wavy boundary.

B3—30 to 40 inches, yellowish-brown (10YR 5/6) loam; few, medium, faint, light yellowish-brown (10YR 6/4) mottles; moderate, medium, subangular blocky structure; friable; very strongly acid; clear, wavy boundary.

C1—40 to 54 inches, yellowish-brown (10YR 5/4) loam; many, medium, distinct, pale-brown (10YR 6/3) mottles; massive; friable; many iron concretions; very strongly acid; clear, wavy boundary.

C2—54 to 67 inches, light brownish-gray (10YR 6/2) clay loam; many, medium, distinct, yellowish-brown (10YR 5/6), very dark grayish-brown (10YR 3/2), and strong-brown (7.5YR 5/6) mottles; massive; friable; many iron concretions; very strongly acid; clear, wavy boundary.

C3—67 to 74 inches, yellowish-brown (10YR 5/4) sandy loam; many, medium, distinct, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/6) mottles; massive, friable; very strongly acid.

The Ap horizon ranges from dark brown to dark yellowish brown. The B2 horizon ranges from dark yellowish brown or yellowish brown to strong brown and from loam to silty clay loam. The C horizon is stratified loam, sandy loam, clay loam, and loamy sand.

Elkinsville soils are similar to Pekin soils. They lack the fragipan and the mottles in the upper part of the B horizon that Pekin soils have.

Elkinsville silt loam, 2 to 6 percent slopes, eroded (ElB2).—This soil is on alluvial terraces along streams. It has the profile described as representative of the Elkinsville series. Runoff is slow.

Included with this soil in mapping were small areas of nearly level soils; small areas of severely eroded soils; and small wooded areas where little erosion has taken place. Also included were small areas of Pekin soils and small areas in which the surface layer is loam.

This Elkinsville soil is suited to most crops commonly grown in the county. Runoff and susceptibility to further erosion is the major limitation. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIe–3; woodland suitability group 1o1.

Elkinsville silt loam, 6 to 12 percent slopes, eroded (ElC2).—This soil is on terrace breaks and along drainageways. Runoff is medium.

Included with this soil in mapping were small wooded areas where little erosion has taken place; small areas in which the surface layer is loam; and small areas of severely eroded soils. Also included were small areas of an Elkinsville soil that is on breaks along drainageways and has slopes greater than 12 percent.

This Elkinsville soil is suited to most crops commonly grown in the county. Runoff and susceptibility to further erosion are the major limitations. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIIe–3; woodland suitability group 1o1.

Gilpin Series

The Gilpin series consists of moderately deep, well-drained, steep soils on uplands. These soils formed in material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 2 inches thick. The subsurface layer, about 9 inches thick, is friable, dark grayish-brown silt loam in the upper part and friable, yellowish-brown channery silt loam in the lower part. The subsoil is about 18 inches thick. The upper 5 inches of the subsoil is friable, yellowish-brown channery silt loam; and the lower 13 inches is friable, strong-brown silty clay loam. The underlying material is sandstone and shale bedrock.

The content of organic matter is low. Available water capacity and pemeability are moderate. Runoff is very rapid. The surface layer is medium acid or strongly acid in areas that have not been limed.

Gilpin soils are suited to pasture and trees. Runoff and susceptibility to erosion are the main limitations that affect use and management. Pasture plants respond well to lime and fertilizer.

Representative profile of Gilpin silt loam from an area of Gilpin-Berks complex, 18 to 30 percent slopes, in a wooded area where the slope is 23 percent and faces south; 1,240 feet west and 600 feet north of the southeast corner of NW¼ sec. 21, T. 2 S., R. 2 E.:

O1—½ inch to 0, partly decomposed leaf litter.
A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; many roots; few fragments of sandstone 2 to 6 centimeters in length; medium acid; clear, wavy boundary.
A21—2 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many roots; few fragments of sandstone 2 to 6 centimeters in length; medium acid; abrupt, wavy boundary.
A22—7 to 11 inches, yellowish-brown (10YR 5/4) channery silt loam; moderate, medium, granular structure; friable; many roots; many fragments of sandstone 4 to 30 centimeters in length; very strongly acid; clear, wavy boundary.
B1—11 to 16 inches, yellowish-brown (10YR 5/6) channery silt loam; moderate, fine and medium, subangular blocky structure; friable; common roots; many fragments of sandstone 4 to 30 centimeters in length; very strongly acid; clear, wavy boundary.
B2t—16 to 29 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable; thin clay films on faces of peds; few roots; common fragments of sandstone 4 to 30 centimeters in length; very strongly acid; clear, wavy boundary.
R—29 inches, hard sandstone and shale bedrock.

The A1 horizon ranges from dark grayish brown to very dark grayish brown. In cultivated areas the Ap horizon is dark brown to dark yellowish brown. The B horizon is yellowish brown to strong brown and ranges from heavy silt loam to clay loam in texture. The content of channery fragments in the B horizon ranges from 5 to 30 percent. Depth to sandstone bedrock ranges from 20 to 36 inches.

Gilpin soils are similar to Berks and Wellston soils. They have a higher content of clay in their B horizon than Berks soils. They are shallower to bedrock than Wellston soils.

Gilpin silt loam, 18 to 25 percent slopes, eroded (GlE2). This soil is on uplands. It has a profile similar to the one described as representative of the series, but the original surface layer and the subsurface layer have been removed by erosion. Runoff is very rapid.

Included with this soil in mapping were small wooded areas where little erosion has taken place; small areas of Wellston soils, mostly on benches; and a few small areas of Berks and Weikert soils. Also included in some places were areas of Hagerstown and Corydon soils, as well as small areas of fine-textured soils underlain by clay shale.

This Gilpin soil is suited to pasture and trees. Runoff and susceptibility to further erosion are the major limitations. Pasture plants respond well to lime and fertilizer. Capability unit VIe–1; woodland suitability group 3o10.

Gilpin silt loam, 18 to 25 percent slopes, severely eroded (GlE3).—This soil is on uplands. It has a profile similar to the one described as representative of the Gilpin series, but the original surface layer and subsurface layer have been removed by erosion. In many places yellowish-brown material from the subsoil is exposed. Small gullies occur throughout most areas. Runoff is very rapid.

Included with this soil in mapping were small areas of Wellston, Berks, and Weikert soils. Also included in some places were areas of Hagerstown and Corydon soils, and small areas of fine-textured soils underlain by clay shale.

This Gilpin soil is suited to trees. Runoff and susceptibility to further erosion are the major limitatons. Capability unit VIIe–2; woodland suitability group 3o10.

Gilpin-Berks complex, 18 to 30 percent slopes (GpE).—The soils in this mapping unit are on uplands. About 50 percent of the acreage is Gilpin silt loam, and 35 percent is Berks channery silt loam. About 15 percent is soils that were included in mapping. Runoff is very rapid.

This Gilpin soil is mainly on benches and in slump areas on hillsides, but it is also in areas between natural drainageways. It has the profile described as representative of the Gilpin series.

The Berks soil is mainly in areas between benches, or shelflike areas, on hillsides. On long hillsides it occupies some areas near the base of escarpmentlike slopes. Some areas are at the lower end of natural drainageways.

Included with these soils in mapping were small areas of Wellston soils on benches and of Weikert soils on breaks. Also included were small areas of fine-textured soils underlain by clay shale; small areas of moderately coarse textured soils underlain by weathered sandstone; and a few small areas of Hagerstown and Corydon soils. There are also small areas of deep colluvial soils at the base of slopes; outcrops of sandstone, limestone, and shale that occur throughout areas mapped as this complex; and a few small areas of moderately eroded or severely eroded soils.

Soils of this mapping unit are suited to trees. Runoff and susceptibility to erosion are the major limitations, but these soils are also stony and shallow. Capability unit VIIe–2; woodland suitability group 3r12.

Gullied Land

Gullied land (Gu) consists of soils that are very severely gullied and that are moderately sloping or strongly sloping in most places. It occurs throughout the county. These soils are underlain by sandstone, shale, or limestone bedrock, which is exposed in most of the gullies. The soil material in areas underlain by sandstone is mostly friable silt loam and silty clay loam that contains many channery fragments. The soil material in areas underlain by shale is mainly firm clay that contains many fragments of shale. The material in areas underlain by limestone is mostly firm, reddish clay.

Included with this land type in mapping were small areas of Zanesville, Wellston, Gilpin, Crider, and Hagerstown soils. These included soils are on narrow ridges between the gullies.

This land type is better suited to trees than to most other uses. Most areas are bare, but weeds and shrubs are starting to grow in some places (fig. 4). The major limitations are runoff and susceptibility to further erosion. Capability unit VIIe–4; woodland suitability group 5r14.

Hagerstown Series

The Hagerstown series consists of deep, well-drained, moderately sloping to steep soils on uplands. These soils formed in a mantle of loess less than 20 inches thick and in the underlying material weathered from limestone. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark-brown silty clay loam about 8 inches thick. The subsoil

***Figure 4.*—Pine trees planted in an area of Gullied land help to control runoff and to stabilize the soil.**

is about 35 inches thick. The upper 4 inches of the subsoil is friable, reddish-brown light silty clay loam; the next 5 inches is firm, red heavy silty clay loam; and the lower 26 inches is firm or very firm, mostly red silty clay and clay. The subsoil is underlain by limestone bedrock.

The content of organic matter is low. Available water capacity is moderate or high, and permeability is moderate. Runoff is medium to very rapid. The surface layer is strongly acid in areas that have not been limed.

Runoff and susceptibility to further erosion affect the use and management of Hagerstown soils. The moderately sloping soils are suited to most crops commonly grown in the county. The strongly sloping or steep soils are better suited to hay, pasture, and trees than to other crops. Crops respond well to lime and fertilizer.

Representative profile of Hagerstown silty clay loam, 6 to 12 percent slopes, severely eroded, in a sod field where the slope is 10 percent and faces east; 925 feet east and 130 feet south of the northwest corner of SE¼ sec. 10, T. 2 S., R. 2 E.:

Ap—0 to 8 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

B1—8 to 12 inches, reddish-brown (2.5YR 4/4) light silty clay loam; weak, medium, subangular blocky structure; friable; neutral; clear, wavy boundary.

IIB21t—12 to 17 inches, red (2.5YR 5/6) heavy silty clay loam; moderate, medium, subangular blocky and angular blocky structure; firm; thin, discontinuous, red (2.5YR 4/6) clay films on faces of peds and lining some voids; strongly acid; clear, smooth boundary.

IIB22t—17 to 25 inches, red (2.5YR 4/6) silty clay; moderate, medium, angular and subangular blocky structure; firm; red (2.5YR 4/6) clay films on faces of peds; strongly acid; clear, smooth boundary.

IIB23t—25 to 42 inches, red (2.5YR 4/6) clay; moderate, fine and medium, angular blocky structure; very thin, continuous, red (10R 4/6) clay films on faces of peds; some black soft concretions of iron and manganese in lower part of horizon; discontinuous, thin pockets and vertical layers of cherty clay, but less than 1 percent, by volume, is stones; soil material extends downward in cracks and crevices to a depth of 60 inches or more; strongly acid; abrupt, irregular boundary.

IIB3—42 to 43 inches, very dusky red (10R 2/2) clay; massive; sticky; neutral; abrupt, irregular boundary.

R—43 inches, limestone bedrock.

The Ap horizon ranges from dark brown to strong brown. The B2 horizon ranges from reddish brown to red. The upper part of the B2 horizon is silty clay loam, but the lower part ranges to silty clay or clay. Thickness of the IIB3 horizon ranges from ½ inch to 1 inch. Depth to bedrock ranges from 40 to 60 inches.

Hagerstown soils are similar to Crider and Corydon soils. They have a thinner mantle of loess and are shallower over bedrock than Crider soils. They are lighter colored and deeper over bedrock than Corydon soils.

Hagerstown silt loam, 12 to 18 percent slopes, eroded (HaD2).—This soil is on side slopes, on breaks around sinkholes, and along drainageways on uplands. It is underlain by limestone. The areas contain many sinkholes. Runoff is rapid.

Included with this soil in mapping were small areas of Crider soils. Small areas of severely eroded soils were also included.

This Hagerstown soil is suited to small grain, hay, and pasture, and it can be used occasionally for corn or soybeans. Runoff and susceptibility to further erosion are the major limitations. Crops respond well to lime

and fertilizer. Capability unit IVe–3; woodland suitability group 1o1.

Hagerstown silt loam, 18 to 25 percent slopes, eroded (HaE2).—This soil is on uplands and is underlain by limestone. It is on side slopes and on breaks adjacent to drainageways. Sinkholes are numerous in some areas. Runoff is very rapid.

Included with this soil in mapping were small areas of Crider and Corydon soils. Also included were small areas of severely eroded soils, and other small wooded areas where little erosion has taken place.

This Hagerstown soil is suitable for pasture and trees. Runoff and susceptibility to further erosion are the major limitations. Pasture plants respond well to lime and fertilizer. Capability unit VIe–1; woodland suitability group 2r6.

Hagerstown silty clay loam, 6 to 12 percent slopes, severely eroded (HgC3).—This soil is on narrow ridgetops, on side slopes around sinkholes, and along drainageways on uplands. It is underlain by limestone. It has the profile described as representative of the series. Most of the surface layer has been removed by erosion, and reddish-brown material from the subsoil is exposed in many places. Small gullies and many sinkholes occur throughout most areas. Runoff is medium.

Included with this soil in mapping were small areas of Crider soils. Also included were small areas of soils that are only moderately eroded.

This Hagerstown soil is suited to small grain, hay, and pasture, and it can be used occasionally for corn or soybeans. Runoff and susceptibility to further erosion are the major limitations. Crops respond well to lime and fertilizer. Capability unit IVe–3; woodland suitability group 1o1.

Hagerstown silty clay loam, 12 to 18 percent slopes, severely eroded (HgD3).—This soil is on side slopes and on breaks around sinkholes and drainageways on uplands. It is underlain by limestone. It has a profile similar to the one described as representative of the series, but most of the surface layer has been removed by erosion. In most places reddish-brown material from the subsoil is exposed. Throughout most areas there are small gullies and a few sinkholes. Runoff is rapid.

Included with this soil in mapping were small areas of Crider soils. Also included were small areas of soils that are only moderately eroded.

This Hagerstown soil is suited to pasture and trees. Runoff and susceptibilty to further erosion is the major limitation. Pasture plants respond well to lime and fertilizer. Capability unit VIe–1; woodland suitability group 1o1.

Haymond Series

The Haymond series consists of deep, well-drained, nearly level soils on flood plains. These soils formed in slightly acid or neutral silty alluvium. This alluvium washed mainly from upland soils that formed primarily in loess and in material weathered from sandstone, siltstone, and shale. Some alluvium washed from material from limestone and calcareous, lacustrine material from soils on terraces. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil is friable, dark-brown silt loam about 39 inches thick. The underlying material is dark-brown silt loam that grades to stratified loam and sandy loam.

The content of organic matter is moderate. Available water capacity is high, and permeability is moderate. Runoff is very slow. The surface layer is slightly acid or neutral in most areas that have not been limed.

Haymond soils are suited to most crops commonly grown in the county, but susceptibility to occasional flooding affects their use and management. Crops respond well to fertilizer.

Representative profile of Haymond silt loam in a sod field where the slope is less than 1 percent; 1,050 feet north and 75 feet east of the southwest corner of NE¼ sec. 24, T. 2 S., R. 1 W.:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B21—9 to 28 inches, dark-brown (10YR 4/3) silt loam; weak, medium, granular structure; friable; neutral; clear, smooth boundary.

B22—28 to 48 inches, dark-brown (10YR 4/3) silt loam; weak, medium and fine, subangular blocky structure; friable; thin, dark-brown (10YR 3/3) coatings of organic matter along cleavage planes and as fillings in old voids; neutral; gradual, smooth boundary.

C—48 to 80 inches, dark-brown (10YR 4/3) silt loam grading to stratified loam and sandy loam at a depth of 70 inches; massive; friable; slightly acid.

The Ap horizon ranges from dark grayish brown to brown. In many places the C horizon contains enough sand to give the soil material a gritty feel. Thin layers of sandy material are in the C horizon in some areas.

Haymond soils are similar to Cuba and Huntington soils. They are less acid than Cuba soils. They are lighter colored in the upper part of the profile than Huntington soils.

Haymond silt loam (0 to 2 percent slopes) (Hm).—This soil is on flood plains adjacent to streams and in sinkhole depressions in the uplands. Runoff is very slow.

Included with this soil in mapping were a few areas of a gently sloping soil along channels created by floodwaters. Also included, and indicated on the soil map by the spot symbol for sand, were small areas of a soil that is sandy throughout. There are also a few small areas of a soil that has gray mottles at a depth of 18 to 30 inches; small areas of wet soils that are indicated on the soil map by the spot symbol for wetness; and a few small areas of soils that are underlain by fragments of rock at a depth of about 18 inches.

This Haymond soil is suited to most crops commonly grown in the county, but susceptibility to occasional flooding affect its use and management. Crops are subject to severe damage during long periods of flooding. The main crops are corn, soybeans, hay, and pasture. Crops respond well to fertilizer. Capability unit I–2; woodland suitability group 1o8.

Henshaw Series

The Henshaw series consists of deep, somewhat poorly drained, nearly level and gently sloping soils on terraces. These soils formed in stratified, slack-water silt and clay. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is brown silt loam about 8 inches thick. The subsurface layer is friable, yellowish-brown silt loam about 5 inches thick. The subsoil is about 25 inches thick and is pale-brown and yellowish-brown silty clay loam mottled with yellowish brown, light brownish gray, and pale brown. The underlying material is yellowish-brown, stratified silt loam, silty clay loam, and silt mottled with light brownish gray and yellowish brown.

The content of organic matter is low. Available water capacity is high, and permeability is moderately slow. Runoff is very slow or slow. In most areas that have not been limed, the surface layer is medium acid.

Wetness affects use and management of Henshaw soils. If properly drained, however, these soils are suited to most crops commonly grown in the county. Crops respond well to lime and fertilizer.

Representative profile of Henshaw silt loam, 0 to 3 percent slopes, in a cultivated field where the slope is less than 1 percent; 1,190 feet east and 1,120 feet south of the northwest corner of SE¼ sec. 5, T. 4 S., R. 2 E.:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A2—8 to 13 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; friable; pale-brown (10YR 6/3) silt coatings on faces of peds; slightly acid; clear, wavy boundary.

B1t—13 to 21 inches, pale-brown (10YR 6/3) light silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; very strongly acid; clear, wavy boundary.

B2t—21 to 38 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; many, medium, distinct, light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; firm; many clay films on faces of peds; very strongly acid; clear, wavy boundary.

C1—38 to 50 inches, yellowish-brown (10YR 5/6), stratified silt loam and silty clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/4) mottles; massive; firm; common iron and manganese concretions; neutral; clear, wavy boundary.

C2—50 to 64 inches, yellowish-brown (10YR 5/4), stratified silt; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; massive; firm; common carbonate concretions; calcareous.

The Ap horizon ranges from brown or dark grayish brown to yellowish brown. The B2 horizon ranges from pale brown to yellowish brown, and it is mottled with light gray to pale brown or yellowish brown. The B2 horizon is mainly heavy silt loam to silty clay loam, but in some areas there is a thin layer of silty clay. The C horizon is mostly stratified silt loam and silty clay loam, but in some places seams of silty clay are also in that horizon.

Henshaw soils are similar to Markland soils. They contain less clay than Markland soils, and they have mottles in the upper part of the profile, which Markland soils lack.

Henshaw silt loam, 0 to 3 percent slopes (HnA).—This soil is on lacustrine terraces. Runoff is very slow or slow. Included in mapping were small areas of well-drained Alford soils.

Use and management of this Henshaw soil are affected mainly by wetness. If this soil is properly drained, however, it is suited to most crops commonly grown in the county. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIw–2; woodland suitability group 3w5.

Huntington Series

The Huntington series consists of deep, well-drained, nearly level soils on flood plains. These soils formed in silty alluvium that is neutral in reaction. In places their profile has mica flakes and seams of sand throughout. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 12 inches thick. The subsoil is about 55 inches thick. The upper 42 inches of the subsoil is friable, dark-brown silt loam; and the lower 13 inches is firm, brown silt loam. The underlying material is brown silt loam.

The content of organic matter is moderate. Available water capacity is high, and permeability is moderate. Runoff is very slow. In most areas that have not been limed, the surface layer is neutral in reaction.

Huntington soils are suited to most crops commonly grown in the county, but susceptibility to occasional flooding affects their use and management. The main crops are corn, soybeans, hay, and pasture. Crops respond well to fertilizer.

Representative profile of Huntington silt loam, in a cultivated field where the slopes are less than 1 percent; 790 feet east and 1,060 feet south of the northwest corner of SW¼ sec. 33, T. 4 S., R. 1 E.:

Ap—0 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium and coarse, granular structure; friable; neutral; abrupt, smooth boundary.

B2—12 to 54 inches, dark-brown (10YR 3/3) silt loam, dark brown (10YR 4/3) if crushed; moderate, fine and medium, subangular blocky structure; friable; neutral; gradual, wavy boundary.

B3—54 to 67 inches, brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; firm; yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) silt films on faces of peds; common concretions of iron and manganese; neutral; gradual, wavy boundary.

C—67 to 90 inches, brown (7.5YR 4/4) silt loam; massive; firm; light yellowish-brown (10YR 6/4) patches of silt; neutral.

The Ap horizon ranges from very dark grayish brown to dark brown. The B2 horizon ranges from dark brown to dark yellowish brown. Reaction of the B2 horizon is slightly acid or neutral.

Huntington soils are similar to Haymond and Cuba soils. They are darker colored than Haymond and Cuba soils. They are less acid than Cuba soils.

Huntington silt loam (0 to 2 percent slopes) (Hu).—This soil is on flood plains. Runoff is very slow.

Included with this soil in mapping were small areas of gently sloping and of moderately sloping soils along sloughs; small areas of moderately steep or steep soils on sharp breaks along the Ohio River; and small areas of moderately well drained soils. Also included were small areas of gray, somewhat poorly drained soils on the bottoms of drainageways; small areas of soils that have a sandy profile and that are indicated on the soil map by a spot symbol for sand; and small areas of soils that are underlain by acid alluvium at a depth of 28 inches or more.

This Huntington soil is suited to most crops commonly grown in the county, but susceptibility to occa-

sional flooding affects its use and management. The major crops are corn, soybeans, hay, and pasture. Crops respond well to fertilizer. Capability unit I–2; woodland suitability group 1o8.

Johnsburg Series

The Johnsburg series consists of deep, nearly level soils that are somewhat poorly drained and have a very firm and brittle fragipan at a depth of about 24 inches. These soils are on broad divides in the uplands. They formed in loess and in the underlying material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 10 inches thick. The subsurface layer is light yellowish-brown silt loam that is mottled with gray and is about 4 inches thick. The subsoil is about 76 inches thick. The upper 10 inches of the subsoil is friable and firm, pale-brown and light yellowish-brown heavy silt loam mottled with yellowish brown, gray, and light gray; the next 48 inches is a very firm and brittle fragipan of gray, yellowish-brown, and brown silty clay loam and silt loam mottled with yellowish brown, dark yellowish brown, and gray; and the lower 18 inches is firm, mostly brown silt loam. The underlying material is partly weathered silty shale.

The content of organic matter is low. Available water capacity is moderate, and permeability is very slow. Runoff is very slow. The surface layer is strongly acid in areas that have not been limed.

Wetness affects the use and management of Johnsburg soils, and the frost-heave potential is high. Nevertheless, if these soils are properly drained, they are suited to most crops commonly grown in the county. They are not well suited to deep-rooted legumes, because the fragipan restricts the depth to which roots can penetrate. Crops respond well to lime and fertilizer.

Representative profile of Johnsburg silt loam in a sod field where the slope is 1 percent; 780 feet north and 780 feet west of the southeast corner of NW¼ sec. 36, T. 3 S., R. 1 E.:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A2—10 to 14 inches, light yellowish-brown (2.5Y 6/4) silt loam; common, fine, distinct, gray (10YR 6/1) mottles; weak, very thick, platy structure parting to weak; medium, subangular blocky; friable; slightly acid; clear, smooth boundary.

B1—14 to 20 inches, pale-brown (10YR 6/3) heavy silt loam; many, medium, distinct, yellowish-brown (10YR 5/4) and gray (10YR 6/1) mottles; weak to moderate, medium, subangular blocky structure; friable; fine, thin, light brownish-gray (10YR 6/2) silt streaks and coatings; strongly acid; clear, smooth boundary.

B21t—20 to 24 inches, light yellowish-brown (10YR 6/4) heavy silt loam; many, coarse, distinct, light-gray (10YR 7/2) mottles; moderate, fine to medium, prismatic structure parting to moderate, medium to coarse, subangular blocky; firm; thin light-gray (10YR 7/2) silt coatings on faces of peds; thin, discontinuous, light-gray (10YR 7/2) clay films in voids and on faces of peds; very strongly acid; clear, smooth boundary.

Bx1—24 to 36 inches, gray (N 6/0) light silty clay loam that is 30 percent clay; many, coarse, prominent, yellowish-brown (10YR 5/8) and dark yellowish-brown (10YR 4/4) mottles; moderate, very coarse, prismatic structure; very firm and brittle; thin gray (N 6/0) clay films on the faces of all peds and as a lining in voids; common, soft, round masses of iron; very strongly acid; gradual, smooth boundary.

IIBx2—36 to 50 inches, yellowish-brown (10YR 5/4 and 5/6) silt loam weathered from coarse-grained siltstone; common, coarse, distinct, gray (10YR 6/1) mottles; moderate, very coarse, prismatic structure; very firm and brittle; thick streaks of gray (10YR 6/1) silt loam extending vertically through horizon; very strongly acid; gradual, smooth boundary.

IIBx3—50 to 72 inches, brown (10YR 5/3) silt loam; moderate, very coarse, prismatic structure parting to weak, thick, platy, very firm and brittle; thin streaks of gray (10YR 6/1) silt, mostly vertical, appear to be around polygonal peds; very strongly acid; gradual, smooth boundary.

IIB3—72 to 90 inches, brown (10YR 5/3) silt loam; massive; firm; few streaks of gray (10YR 6/1) silt; strongly acid; gradual, smooth boundary.

C—90 inches, weathered silty shale.

The Ap horizon ranges from dark grayish brown to dark yellowish brown. The B horizon ranges from pale brown or light yellowish brown to light gray, gray, or brown and from silt loam to silty clay loam. The fragipan is at a depth of 18 to 36 inches, and it ranges from 24 to 48 inches in thickness. In some places the fragipan formed entirely in loess. In others it formed partly in loess and partly in material weathered from bedrock. Depth to bedrock ranges from 4 to 10 feet. Bedrock is stratified sandstone, siltstone, and shale.

Johnsburg soils are similar to Tilsit and Bartle soils. They are mottled at a shallower depth than Tilsit soils. They formed partly in material weathered from sandstone and shale, whereas Bartle soils formed in stratified silt and fine sand.

Johnsburg silt loam (0 to 2 percent slopes) (Jo).—This soil is on broad divides and in small depressions in the uplands. Runoff is very slow.

Included with this soil in mapping were small areas of Tilsit soils, and small areas where slopes are 3 to 4 percent. Also included were small areas of soils that are light gray and poorly drained.

Wetness is the major limitation that affects use and management of this Johnsburg soil. This soil is suited to most crops commonly grown in the county, however, if it is properly drained. It is not well suited to deep-rooted legumes, because the fragipan restricts the depth to which roots can penetrate. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIIw–3; woodland suitability group 3w5.

Markland Series

The Markland series consists of deep, well-drained, moderately sloping to very steep soils on lacustrine terraces. These soils formed in stratified lacustrine clay and silt. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is very dark grayish-brown silt loam about 1 inch thick. The subsurface layer is friable, dark grayish-brown and pale-brown silt loam about 7 inches thick. The subsoil is about 21 inches thick. The upper 5 inches of the subsoil is friable, yellowish-brown silty clay loam; and the lower 16 inches is firm, yellowish-brown silty clay. The underlying material is brown, stratified silt loam and silty clay.

The content of organic matter is low. Available water capacity is high, and permeability is slow. Runoff is

medium in the moderately sloping areas and very rapid in the very steep areas. The surface layer is slightly acid or neutral in most areas that have not been limed.

Markland soils are suited to permanent pasture and trees. Runoff and susceptibility to erosion are the major limitations. Pasture plants respond well to fertilizer.

Representative profile of Markland silt loam in an area of Markland silt loam, 12 to 18 percent slopes, eroded, in a wooded area where the slope is 15 percent and faces north; 920 feet east and 725 feet north of the southwest corner of SE1/4 sec. 5, T. 4 S., R. 2 E.:

O1—1 inch to 0, partly decomposed leaf litter.

A1—0 to 1 inch, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A21—1 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; neutral; clear, wavy boundary.

A22—5 to 8 inches, pale-brown (10YR 6/3) silt loam; moderate, medium, subangular blocky structure; friable; grayish-brown (10YR 5/2) silt fillings in old root channels; neutral; abrupt, wavy boundary.

B21t—8 to 13 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; friable; thin yellowish-brown (10YR 5/4) clay films on faces of peds; grayish-brown (10YR 5/2) silt fillings in old root channels; slightly acid; abrupt, wavy boundary.

IIB22t—13 to 20 inches, yellowish-brown (10YR 5/4) silty clay; moderate, medium, angular blocky structure; firm; thin yellowish-brown (10YR 5/4) clay films on faces of peds; slightly acid; clear, wavy boundary.

IIB23t—20 to 29 inches, yellowish-brown (10YR 5/4) silty clay; moderate, medium, angular blocky structure; firm; thin dark yellowish-brown (10YR 4/4) clay films on faces of peds; neutral; clear, wavy boundary.

IIC—29 to 60 inches, brown (10YR 5/3), stratified silt loam and silty clay; massive; friable; dark-brown (10YR 4/3) clay flows; calcareous.

The Ap horizon ranges from dark grayish brown to yellowish brown in areas that have been cultivated. The B2 horizon ranges from brown to yellowish brown. Texture of the B2 horizon ranges from silty clay loam in the upper part of the horizon to silty clay or clay in the lower part. Reaction of the B2 horizon ranges from medium acid to neutral. Depth to calcareous material ranges from 15 to 36 inches.

Markland soils are similar to Henshaw soils. They have a B horizon of silty clay or clay, which Henshaw soils lack, and they lack mottles, which Henshaw soils have.

Markland silt loam, 12 to 18 percent slopes, eroded (MaD2).—This soil is on lacustrine terraces. It occupies breaks and is in areas adjacent to drainageways. The profile is similar to the one described as representative of the series, but the original surface layer and most of the subsurface layer have been removed by erosion. Runoff is rapid.

Included with this soil in mapping were small areas of soils that have a silty subsoil, and small wooded areas in which little erosion has taken place. Also included were a few small areas of severely eroded soils.

This Markland soil is suited to permanent pasture and trees. Runoff and susceptibility to further erosion are the major limitations. Pasture plants respond well to fertilizer. Capability unit VIe–1; woodland suitability group 3r18.

Markland silt loam, 25 to 70 percent slopes (MaF).—This soil is on lacustrine terraces. It occupies breaks and is in areas adjacent to drainageways. The profile is similar to the one described as representative of the series, but it is thinner and, in places, calcareous material is exposed. Runoff is very rapid.

Included with this soil in mapping were small areas of soils that have a silty solum and small areas of eroded soils. Also included were small areas where slopes are greater than 70 percent or are less than 25 percent.

This Markland soil is suited to trees. Runoff and susceptibility to erosion are the major limitations. Capability unit VIIe–1; woodland suitability group 3r18.

Markland silty clay loam, 6 to 12 percent slopes, severely eroded (McC3).—This soil is on lacustrine terraces. It is on terrace breaks and is adjacent to drainageways. The profile is similar to the one described as representative of the series, but the original surface layer and the subsurface layer have been removed by erosion. In many places yellowish-brown material from the subsoil is exposed. Runoff is medium.

Included with this soil in mapping were small areas of soils that have a silty surface layer and subsoil. Also included were small wooded areas in which little erosion has taken place.

This Markland soil is suited to permanent pasture and trees. Runoff and susceptibility to further erosion are the major limitations. Pasture plants respond well to fertilizer. Capability unit VIe–1; woodland suitability group 3r18.

Markland silty clay loam, 12 to 18 percent slopes, severely eroded (McD3).—This soil is on lacustrine terraces. It occurs on breaks and in areas adjacent to drainageways. The profile is similar to the one described as representative of the series, but the original surface layer and the subsurface layer have been removed by erosion. In many places yellowish-brown material from the subsoil is exposed. Small gullies occur throughout most areas.

Included with this soil in mapping were small areas of soils that have a silty surface layer and subsoil. Also included were small areas of soils that are moderately eroded.

This Markland soil is suited to trees. Runoff and susceptibility to erosion are the major limitations. Capability unit VIIe–1; woodland suitability group 3r18.

Pekin Series

The Pekin series consists of deep, moderately well drained, gently sloping soils that have a very firm and brittle fragipan at a depth of about 30 inches. These soils formed in stratified silt and fine sand on alluvial terraces adjacent to streams. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark yellowish-brown loam about 5 inches thick. The subsurface layer is yellowish-brown silt loam about 6 inches thick. The subsoil is about 65 inches thick. The upper 20 inches of the subsoil is friable, yellowish-brown and light yellowish-brown silt loam that is mostly mottled with light brownish gray and yellowish brown and the lower 45 inches is a very firm and brittle fragipan of light yellowish-brown, yellowish-brown, and light brownish-gray silt loam mottled with yellowish brown, light brownish gray, light yellowish brown, and brown. The underlying material is light brownish-gray silt loam

mottled with yellowish brown and light yellowish brown.

The content of organic matter is low. Available water capacity is moderate, and permeability is very slow. Runoff is slow. In areas that have not been limed, the surface layer is strongly acid.

Pekin soils are suited to most crops commonly grown in the county. They are not well suited to deep-rooted legumes, however, because the fragipan restricts the depth to which roots can penetrate. Runoff and susceptibility to erosion are the major limitations to use and management, but the frost-heave potential is also high. Crops respond well to lime and fertilizer.

Representative profile of Pekin silt loam, 2 to 6 percent slopes, in a sod field where the slope is 3 percent; 925 feet east and 1,090 feet north of the southwest corner of NW¼ sec. 2, T. 3 S., R. 1 W.:

Ap—0 to 5 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, granular structure; friable; neutral; clear, wavy boundary.

A2—5 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure parting to moderate, medium, granular; friable; light yellowish-brown (10YR 6/4) silt flows along root channels; strongly acid; abrupt, smooth boundary.

B21t—11 to 20 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) silt films and clay films on faces of peds; very strongly acid; clear, wavy boundary.

B22t—20 to 26 inches, yellowish-brown (10YR 5/6) heavy silt loam; few, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) clay films on faces of peds; light yellowish-brown (10YR 6/4) silt flows along root channels; very strongly acid; clear, wavy boundary.

B23t—26 to 31 inches, light yellowish-brown (10YR 6/4) silt loam; many, medium, distinct, yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; thin discontinuous clay films; very strongly acid; clear, wavy boundary.

Bx1—31 to 43 inches, light yellowish-brown (10YR 6/4) silt loam; many, medium, distinct, yellowish-brown (10YR 5/6 and 5/4) and light brownish-gray (10YR 6/2) mottles; moderate, very coarse, prismatic structure parting to weak, medium, subangular blocky; very firm and brittle; thin discontinuous clay films; very strongly acid; clear, wavy boundary

Bx2—43 to 58 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, distinct, light brownish-gray (10YR 6/2) and light yellowish-brown (10YR 6/4) mottles; moderate, very coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm and brittle; thin discontinuous clay films; very strongly acid; clear, wavy boundary.

Bx3—58 to 76 inches, light brownish-gray (10YR 6/2) silt loam; many, medium and coarse, distinct, yellowish-brown (10YR 5/6), light yellowish-brown (10YR 6/4), and brown (7.5YR 4/4) mottles; moderate, very coarse, prismatic structure; very firm and brittle; thin discontinuous clay films; few iron stains on faces of peds; very strongly acid; clear, wavy boundary.

C—76 to 82 inches, light brownish-gray (10YR 6/2) silt loam; many, medium, distinct, yellowish-brown (10YR 5/6) and light yellowish-brown (10YR 6/4) mottles; massive; friable; very strongly acid.

The Ap horizon ranges from dark grayish brown to yellowish brown or dark yellowish brown. The B horizon ranges from yellowish brown or light yellowish brown to light brownish gray and from silt loam to silty clay loam. The fragipan is at a depth of 18 to 36 inches and ranges from 10 to 46 inches in thickness.

Pekin soils are similar to Tilsit and Bartle soils. They are underlain by stratified silt and sand, whereas Tilsit soils formed partly in material weathered from sandstone, siltstone, or shale. Pekin soils are more brownish than Bartle soils, and they lack mottling in the upper part of the profile, whereas Bartle soils are mottled in the upper part of the profile.

Pekin silt loam, 2 to 6 percent slopes (PeB).—This soil is on alluvial terraces along streams. Runoff is slow.

Included with this soil in mapping were small areas of somewhat poorly drained Bartle soils and of well-drained Elkinsville and Wheeling soils. Also included were small areas of nearly level soils.

Runoff and susceptibility to erosion are the major limitations that affect use and management of this Pekin soil. In addition, most roots cannot penetrate the very slowly permeable fragipan. This soil is suited, however, to most crops commonly grown in the county. It is not well suited to deep-rooted legumes, because the roots of those plants cannot penetrate the fragipan. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIe–7; woodland suitability group 3d9.

Quarries

Quarries (Qu) is a land type that occurs throughout the county. It consists mainly of limestone quarries, but a sandstone quarry occupies one area southeast of Taswell. Most areas are bare, but weeds and shrubs have started to grow in some places.

Included with this land type in mapping were spoil areas around quarries and a small strip mine southwest of Grantsburg.

This land type is better suited to wildlife habitat and recreation than to trees or to most other uses. Susceptibility of the spoil areas to erosion is the major concern of management. Capability unit VIIe–3; woodland suitability group 4r16.

Tilsit Series

The Tilsit series consists of deep, moderately well drained, nearly level and gently sloping soils that have a very firm and brittle fragipan at a depth of about 24 inches. These soils are on uplands, where they formed in loess and in the underlying material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark-brown silt loam about 6 inches thick. The subsoil is about 51 inches thick. The upper 5 inches of the subsoil is friable, dark yellowish-brown silt loam; the next 18 inches is yellowish-brown silty clay loam that is mottled with light yellowish brown and light brownish gray in the lower part; the next 17 inches is a very firm and brittle fragipan of yellowish-brown silt loam mottled with light yellowish brown; and the lower 11 inches is friable, light-gray loam mottled with brownish yellow. The underlying material is sandstone and shale bedrock.

The content of organic matter is low. Available water capacity is moderate, and permeability is very slow. Runoff is very slow or slow. In most areas that have not been limed, the surface layer is strongly acid.

Wetness affects use and management of the nearly

level areas of Tilsit soils. Runoff and susceptibility to erosion are the major limitations in areas of gently sloping Tilsit soils. The frost-heave potential is high. Nevertheless, these soils are suited to most crops commonly grown in the county. They are not well suited to deep-rooted legumes, because the roots of those plants cannot penetrate the fragipan. Crops respond well to lime and fertilizer.

Representative profile of Tilsit silt loam, 2 to 6 percent slopes, eroded, in a sod field where the slopes are 3 percent and face north; 530 feet east and 925 feet south of the northwest corner of SE¼ sec. 20, T. 2 S., R. 1 W.:

Ap—0 to 6 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B1—6 to 11 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; neutral; abrupt, wavy boundary.

B21t—11 to 23 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; strong-brown (7.5YR 5/6) clay films on faces of peds and in root channels; very strongly acid; clear, wavy boundary.

B22t—23 to 29 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, medium, distinct, light yellowish-brown (10YR 6/4) and light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear, wavy boundary.

IIBxt—29 to 46 inches, yellowish-brown (10YR 5/6) silt loam; many, medium and coarse, distinct, light yellowish-brown (10YR 6/4) mottles; moderate, very coarse, prismatic structure parting to moderate, medium, subangular blocky; very firm and brittle; thin, dark-brown (7.5YR 4/4) clay films in discontinuous voids; many gray (10YR 6/1) clay flows as much as 10 millimeters thick; light-gray (10YR 7/1) silt coatings on faces of peds, mainly in the upper part of horizon; few weathered fragments of sandstone; common, fine, discontinuous voids; very strongly acid; clear, wavy boundary.

IIB3—46 to 57 inches, light-gray (10YR 7/1) loam; many, medium, distinct, brownish-yellow (10YR 6/6) mottles; massive; friable; very strongly acid.

R—57 inches, sandstone and shale bedrock.

The Ap horizon ranges from dark brown to yellowish brown. The B horizon ranges from brown to yellowish brown and dark yellowish brown. Mottling in the B horizon ranges from light yellowish brown and brownish yellow to light brownish gray or gray. Texture of the B horizon ranges from silt loam to silty clay loam. The IIBxt horizon commonly contains enough sand to give it a gritty feel. The fragipan is at a depth of 18 to 36 inches and ranges from 10 to 36 inches in thickness.

Tilsit soils are similar to Zanesville and Pekin soils. They have grayish mottles higher in the profile than Zanesville soils. They formed partly in material weathered from sandstone, siltstone, or shale, whereas Pekin soils formed in stratified silt and fine sand.

Tilsit silt loam, 0 to 2 percent slopes (TlA).—This soil is on ridgetops. It has a profile similar to the one described as representative of the Tilsit series, but the surface layer is thicker. Runoff is very slow. Included with this soil in mapping were small areas of Johnsburg and Zanesville soils.

This Tilsit soil is suited to most crops commonly grown in the county. Wetness limits its use, however, and affects its management. The very slowly permeable fragipan restricts drainage, and it confines most roots to the soil zone above the pan. As a result, this soil is not well suited to deep-rooted legumes, for the roots of these plants generally cannot penetrate the pan. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIw–5; woodland suitability group 3d9.

Tilsit silt loam, 2 to 6 percent slopes, eroded (TlB2).—This soil is on ridgetops. It has the profile described as representative of the series. Runoff is slow.

Included with this soil in mapping were small areas of Johnsburg and Zanesville soils, and a few small wooded areas in which little erosion has taken place. Also included were small areas of severely eroded soils.

This Tilsit soil is suited to most crops commonly grown in the county. Runoff and susceptibility to further erosion are the major limitations. In addition, the very slowly permeable fragipan restricts drainage and confines most roots to the soil zone above the pan. As a result, this soil is not well suited to deep-rooted legumes, for the roots of those plants generally cannot penetrate the pan. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIe–7; woodland suitability group 3d9.

Wakeland Series

The Wakeland series consists of deep, somewhat poorly drained, nearly level soils on flood plains. These soils formed in slightly acid or neutral alluvium. This alluvium was derived mainly from upland soils that formed primarily in loess and in material weathered from sandstone, siltstone, and shale. To a lesser extent, the alluvium is derived from material from limestone and calcareous material from soils on lacustrine terraces. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark grayish-brown silt loam about 3 inches thick. The subsoil is about 20 inches thick. It is mainly friable, grayish-brown silt loam mottled with pale brown and dark brown, but it has thin layers of loam in the upper 5 inches. The underlying material is dark-brown silt loam mottled with grayish brown.

The content of organic matter is low. Available water capacity is high, and permeability is moderate. Runoff is very slow. The surface layer is slightly acid or neutral in areas that have not been limed.

Wetness limits use and affects management of Wakeland soils, and occasional flooding is a hazard. If properly drained, however, these soils are suited to most crops commonly grown in the county. Crops respond well to fertilizer.

Representative profile of Wakeland silt loam in a sod field where the slope is less than 1 percent; 775 feet east and 525 feet north of the southwest corner of NE¼ sec. 3, T. 2 S., R. 1 W.:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B21—3 to 8 inches, grayish-brown (10YR 5/2), thin, stratified layers of silt loam and loam; many, medium, distinct, pale-brown (10YR 6/3) and dark-brown (10YR 4/3) mottles; weak, fine, granular structure; friable; neutral; abrupt, smooth boundary.

B22—8 to 23 inches, grayish-brown (2.5Y 5/2) silt loam; common, fine, distinct, dark-brown (10YR 4/3 and 3/3) mottles; moderate, medium, granular structure; friable;

many iron and manganese concretions; slightly acid; abrupt, smooth boundary.

C—23 to 60 inches, dark-brown (10YR 4/3) silt loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; friable; few sandstone rocks; slightly acid.

In areas that are cultivated, the Ap horizon ranges from dark grayish brown to brown. The B2 horizon ranges from grayish brown to pale brown. The C horizon commonly contains enough sand to give it a gritty feel. In places thin layers of loam and sandy loam are in the C horizon.

Wakeland soils are similar to Haymond soils. They are more grayish than Haymond soils, and they have mottles, which Haymond soils lack.

Wakeland silt loam (0 to 2 percent slopes) (Wa).—This soil is on flood plains adjacent to streams. Runoff is very slow.

Included with this soil in mapping were a few small areas of soils that are moderately well drained. Also included were areas of soils that have a sandy profile.

If properly drained, this Wakeland soil is suited to most crops commonly grown in the county. Its use and management are limited by wetness, and occasional flooding is a hazard. Crops are subject to severe damage during long periods of flooding. Corn, soybeans, hay, and pasture are the main crops. Crops respond well to fertilizer. Capability unit IIw-7; woodland suitability group 2w13.

Weikert Series

The Weikert series consists of excessively drained, very steep soils that are shallow over bedrock. These soils formed in material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is very dark gray and grayish-brown silt loam about 2 inches thick. The subsoil is friable, yellowish-brown channery silt loam about 13 inches thick. The underlying material is cemented sandstone bedrock.

The content of organic matter is low. Available water capacity is very low, and permeability is moderately rapid. Runoff is very rapid. In areas that have not been limed, the surface layer is very strongly acid.

Weikert soils are better suited to trees and to use for recreation than to field crops or pasture. Runoff and susceptibility to erosion limit their use and affect their management.

Representative profile of Weikert channery silt loam from a wooded area of Berks-Gilpin-Weikert complex, 25 to 75 percent slopes, where the slope is 28 percent and faces south; 400 feet north and 100 feet west of the southeast corner of sec. 5, T. 4 S., R. 1 E.:

O1—1 to ½ inch, undecomposed leaf litter.

O2—½ inch to 0, partly decomposed leaf litter.

A1—0 to 1 inch, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—1 to 2 inches, grayish-brown (10YR 5/2) silt loam; moderate, medium, granular structure; friable; very strongly acid; abrupt, smooth boundary.

B2—2 to 15 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, medium, subangular blocky structure; friable; 50 to 60 percent fragments of sandstone; very strongly acid; abrupt, irregular boundary.

R—15 inches, sandstone bedrock.

The A horizon ranges from very dark gray to very dark grayish brown or grayish brown. The B2 horizon ranges from dark brown to yellowish brown. The content of channery fragments in the B2 horizon ranges from 35 to 60 percent. Depth to bedrock ranges from 8 to 20 inches.

Weikert soils are similar to Berks soils, but they are shallower over bedrock than Berks soils.

In Crawford County Weikert soils are mapped only in a complex with Berks and Gilpin soils.

Wellston Series

The Wellston series consists of moderately deep and deep, well-drained, moderately sloping to strongly sloping soils on uplands. These soils formed in loess and in material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile (fig. 5), the surface layer is dark grayish-brown silt loam about 1 inch thick. Beneath the surface layer is a subsurface layer of friable, brown silt loam about 8 inches thick. The subsoil is about 38 inches thick. The upper 4 inches of the subsoil is friable, strong-brown silt loam; the next 19 inches is firm, strong-brown silty clay loam; and the lower 15 inches is firm and friable, yellowish-brown and brown silty clay loam. The underlying material is yellowish-brown and brownish-yellow, weathered sandstone and shale. Bedrock is at a depth of about 52 inches.

The content of organic matter is low. Available water capacity is moderate or high, and permeability is moderate. Runoff is medium or rapid. The surface layer is strongly acid in most areas that have not been limed.

Wellston soils are suited to most crops commonly grown in the county. Runoff and susceptibility to further erosion are the major limitations. Crops respond well to lime and fertilizer.

Representative profile of a Wellston silt loam from an area of Wellston silt loam, 12 to 18 percent slopes, eroded, in a wooded area where the slope is 15 percent and faces southwest; 1,320 feet north and 50 feet west of the southeast corner of sec. 10, T. 2 S., R. 2 W.:

A1—0 to 1 inch, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A21—1 to 5 inches, brown (10YR 5/3) silt loam; moderate, fine and medium, platy structure; friable; medium acid; clear, smooth boundary.

A22—5 to 9 inches, brown (7.5YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; extremely acid; clear, smooth boundary.

B1—9 to 13 inches, strong-brown (7.5YR 5/6) heavy silt loam; weak, medium, subangular blocky structure; friable; extremely acid; clear, smooth boundary.

B21t—13 to 22 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; firm; dark-brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear, smooth boundary.

B22t—22 to 26 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; firm; dark-brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear, smooth boundary.

IIB23t—26 to 32 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky and angular blocky structure; firm; light brownish-gray (10YR 6/2) clay films and silt coatings on faces of peds; very strongly acid; clear, wavy boundary.

IIB31t—32 to 37 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, medium, subangular blocky structure; firm; light brownish-gray (10YR 6/2), thin clay films and silt coatings on faces of peds; few fine fragments of shale; very strongly acid; clear, smooth boundary.

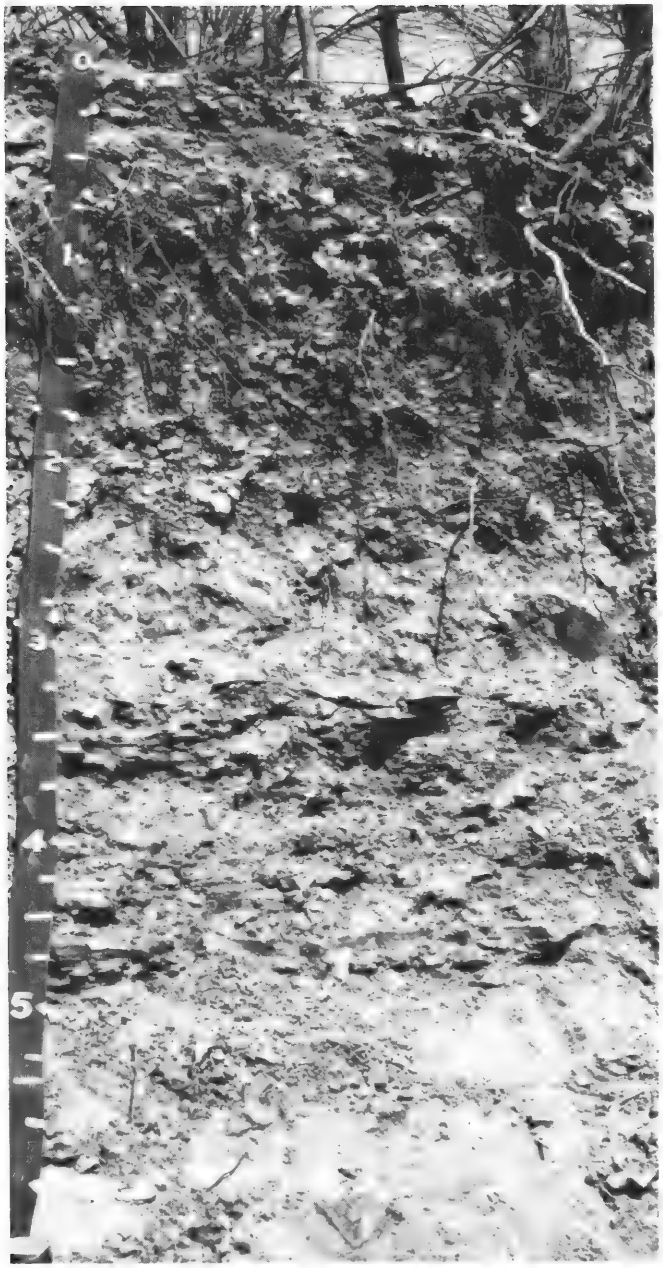

Figure 5.—**Representative profile of a Wellston soil.**

IIB32—37 to 47 inches, yellowish-brown (10YR 5/6) and brown (10YR 5/3) silty clay loam; common, medium, distinct, gray (10YR 6/1) mottles; weak, medium, subangular blocky structure; friable; gray (10YR 6/1) silt coatings on faces of peds; 10 to 15 percent of horizon is fragments of sandstone and shale; few iron and manganese concretions; very strongly acid; clear, wavy boundary.

C—47 to 52 inches, yellowish-brown (10YR 5/6) and brownish-yellow (10YR 6/6) weathered sandstone and shale; massive; friable; light-gray (10YR 7/1) silt coatings; 10 percent fragments of sandstones; very strongly acid.

R—52 inches, sandstone and shale bedrock.

The A horizon ranges from very dark grayish brown or dark grayish brown to brown or yellowish brown. The B2 horizon ranges from light yellowish brown or yellowish brown to strong brown or reddish brown. In the upper part of the B2 horizon, texture ranges from heavy silt loam to silty clay loam. In the lower part, it ranges to clay loam or silty clay in some places. Depth to bedrock ranges from 36 to 60 inches.

Wellston soils are similar to Gilpin and Alford soils. They are deeper over bedrock than Gilpin soils. They are shallower over bedrock than Alford soils, and they formed partly in material weathered from sandstone, siltstone, and shale, whereas Alford soils formed entirely in loess.

Wellston silt loam, 6 to 12 percent slopes, eroded (WeC2).—This soil is on sandstone uplands. Its profile is similar to the one described as representative of the series, but the original surface layer and most of the subsurface layer have been removed by erosion. Runoff is medium.

Included with this soil in mapping were a few small areas where slopes are less than 6 percent. Also included were small areas of Zanesville and Gilpin soils and small areas of soils underlain by clay shale.

This Wellston soil is suited to most crops commonly grown in the county. Runoff and susceptibility to further erosion are its major limitations. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIIe-3; woodland suitability group 3o10.

Wellston silt loam, 6 to 12 percent slopes, severely eroded (WeC3).—This soil is on sandstone uplands. It has a profile similar to the one described as representative of the series, but all of the original surface layer and the subsurface layer have been removed by erosion. In many places strong-brown material from the subsoil is exposed. Small gullies occur throughout most areas. Runoff is medium.

Included with this soil in mapping were small areas of Zanesville and Gilpin soils and small areas of moderately eroded soils. Also included were small areas underlain by clay shale.

This Wellston soil is suited to small grain, hay, and pasture, and it can be used occasionally for corn or soybeans. Runoff and susceptibility to further erosion are its major limitations. Crops respond well to lime and fertilizer. Capability unit IVe-3; woodland suitability group 3o10.

Wellston silt loam, 12 to 18 percent slopes, eroded (WeD2).—This soil is on side slopes and is adjacent to drainageways. It has a profile similar to the one described as representative of the series, but the original surface layer and most of the subsurface layer have been removed by erosion. Runoff is rapid.

Included with this soil in mapping were small areas of Gilpin soils and small areas of soils underlain by clay shale. Also included were small areas of severely eroded soils.

This Wellston soil is suited to small grain, hay, and pasture. Runoff and susceptibility to further erosion are its major limitations. Crops respond well to lime and fertilizer. Capability unit IVe-3; woodland suitability group 3o10.

Wellston silt loam, 12 to 18 percent slopes, severely eroded (WeD3).—This soil is on side slopes and is adjacent to drainageways. It has a profile similar to the one described as representative of the series, but the original surface and subsurface layers have been removed by erosion and strong-brown material from the subsoil

is exposed. Small gullies occur throughout most areas. Runoff is rapid.

Included with this soil in mapping were small areas of Gilpin soils, of Gullied land, and of soils underlain by clay shale. Also included in some places were areas of Hagerstown soils and small areas of moderately eroded soils.

This Wellston soil is suited to hay and pasture. Runoff and susceptibility to further erosion are the major limitations. Hay and pasture plants respond well to lime and fertilizer. Capability unit VIe-1; woodland suitability group 3o10.

Wheeling Series

The Wheeling series consists of deep, well-drained, nearly level to steep soils on alluvial terraces. These soils formed in stratified silt and sand. The native vegetation was mixed hardwoods.

In a representative profile, the surface layer is dark-brown loam about 11 inches thick. The subsoil is about 68 inches thick. The upper 6 inches of the subsoil is friable, dark yellowish-brown loam; the next 18 inches is friable, yellowish-brown light silty clay loam; the next 32 inches is friable, dark yellowish-brown silt loam; and the lower 12 inches is friable, yellowish-brown, stratified silt loam and loam. The underlying material is dark yellowish-brown, stratified sand, silt, and gravel.

The content of organic matter is low. Available water capacity is high, and permeability is moderate. Runoff is very slow in the nearly level areas, but it ranges to very rapid in the steep and very steep areas. The surface layer is strongly acid in areas that have not been limed.

Wheeling soils are suited to most crops commonly grown in the county. Runoff and susceptibility to erosion are the major limitations. Crops respond well to lime and fertilizer.

Representative profile of Wheeling loam, 0 to 2 percent slopes, in a sod field where the slope is less than 1 percent; 1,000 feet north and 650 feet west of the southeast corner of NW¼ sec. 29, T. 4 S., R. 2 E.:

Ap—0 to 11 inches, dark-brown (10YR 4/3) loam; moderate, medium, granular structure; friable; slightly acid; abrupt, smooth boundary.

B1—11 to 17 inches, dark yellowish-brown (10YR 4/4) loam; moderate, medium, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

B21t—17 to 35 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear, wavy boundary.

B22t—35 to 67 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) clay films on faces of peds; pale-brown (10YR 6/3) silt patches throughout horizon; very strongly acid; gradual, wavy boundary.

B3—67 to 79 inches, yellowish-brown (10YR 5/4), stratified silt loam and loam; moderate, medium, subangular blocky structure; friable; brown (7.5YR 4/4) clay films on faces of peds; friable; very strongly acid; clear, wavy boundary.

C—79 to 87 inches, dark yellowish-brown (10YR 4/4), stratified sand, silt, and gravel; massive; friable; very strongly acid.

The Ap horizon is dark brown or brown. The B2 horizon ranges from yellowish brown or brown to dark yellowish brown. In the upper part of the B2 horizon, texture ranges from loam to silty clay loam. In some places in the lower part of the B2 horizon, texture ranges to fine sandy loam. The B21t and B22t horizons contain enough sand to give them a gritty feel.

Wheeling soils are similar to Alford soils. They are coarser textured than Alford soils.

Wheeling loam, 0 to 2 percent slopes (WhA).—This soil is on alluvial terraces. It has the profile described as representative of the series. Runoff is very slow.

Included with this soil in mapping were small areas of Pekin soils and small areas in which the surface layer is silt loam. Also included were small areas of a soil that has a sandy profile and that are indicated on the soil map by the spot symbol for sand.

This Wheeling soil is suited to all the crops commonly grown in the county. The major crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit I-1; woodland suitability group 1o1.

Wheeling loam, 2 to 6 percent slopes, eroded (WhB2).—This soil is on alluvial terraces, where it occupies side slopes and areas adjacent to drainageways. Its profile is similar to the one described as representative of the series, but much of the original plow layer has been removed by erosion. Runoff is slow.

Included with this soil in mapping were small areas of Pekin soils; small areas of soils that are severely eroded; and small areas of a Bartle soil on the bottom of drainageways. Also included were small areas in which the surface layer is silt loam, and, in some places, areas of soils that have a sandy profile and that are shown on the soil map by the spot symbol for sand.

This Wheeling soil is suited to most of the crops commonly grown in the county. Runoff and susceptibility to further erosion are the major limitations. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIe-3; woodland suitability group 1o1.

Wheeling loam, 6 to 12 percent slopes, eroded (WhC2). This soil is on alluvial terraces. It occupies short side slopes and is adjacent to drainageways. The profile is similar to the one described as representative of the series, but much of the surface layer has been removed by erosion. Runoff is medium.

Included with this soil in mapping were small areas of soils that are severely eroded; small areas in which the surface layer is silt loam; and small wooded areas in which little erosion has taken place. Also included in some places were areas of soils that have a sandy profile and that are indicated on the soil map by the spot symbol for sand.

This Wheeling soil is suited to most crops commonly grown in the county. Runoff and susceptibility to further erosion are the major limitations. The main crops are corn, soybeans, small grain, hay, and pasture. Crops respond well to lime and fertilizer. Capability unit IIIe-3; woodland suitability group 1o1.

Wheeling loam, 12 to 25 percent slopes, eroded (WhE2). This soil is on alluvial terraces. It occupies short breaks along drainageways and streams. The profile is similar to the one described as representative of the series, but much of the surface layer has been removed by erosion. Runoff is very rapid.

Included with this soil in mapping were small areas of soils that are severely eroded; small wooded areas where little erosion has taken place; and areas of soils that are on breaks along drainageways and have slopes greater than 25 percent. Also included in some places were areas of soils that have a sandy profile and that are shown on the soil map by the spot symbol for sand.

This Wheeling soil is suited to hay crops and pasture. Runoff and susceptibility to further erosion are its major limitations. Crops respond well to lime and fertilizer. Capability unit VIe-1; woodland suitability group 1r2.

Zanesville Series

The Zanesville series consists of deep, well-drained, moderately sloping soils that have a very firm and brittle fragipan at a depth of about 24 inches. These soils are on uplands. They formed in loess and in underlying material weathered from sandstone, siltstone, and shale. The native vegetation was mixed hardwoods.

In a representative profile (fig. 6), the surface layer is dark-brown silt loam about 9 inches thick. The subsoil is about 67 inches thick. The upper 15 inches of the subsoil is friable, dark-brown and strong-brown silt loam; the middle 20 inches is a very firm and brittle fragipan of dark yellowish-brown silt loam that is mottled with light brownish gray; and the lower 32 inches of the subsoil is firm, strong-brown silty clay mottled with gray and dark reddish brown. The underlying material is stratified, weathered clay shale.

The content of organic matter is low. Available water capacity is moderate, and permeability is very slow. Runoff is medium. In most areas that have not been limed, the surface layer is strongly acid.

If properly managed, Zanesville soils are suited to most crops commonly grown in the county. They are not well suited to deep-rooted legumes, however, because the roots of those plants cannot penetrate the fragipan. Runoff and susceptibility to erosion limit use and affect the management of these soils, and the frost-heave potential is high. Crops respond well to lime and fertilizer.

Representative profile of Zanesville silt loam, 6 to 12 percent slopes, eroded, in a sod field where the slope is 8 percent and faces north; 795 feet east and 370 feet south of the northwest corner of SE¼ sec. 27, T. 3 S., R. 1 E.:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

B1—9 to 14 inches, dark-brown (7.5YR 4/4) heavy silt loam; weak, medium, subangular block structure; friable; neutral; clear, wavy boundary.

B21t—14 to 24 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium, subangular blocky structure; friable; thin, discontinuous, dark-brown (10YR 4/3) clay films on faces of peds and lining some voids; strongly acid; clear, irregular boundary.

Bx—24 to 44 inches, dark yellowish-brown (10YR 4/4) silt loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate or strong, very coarse, prismatic structure; very firm and brittle; dark-brown (7.5YR 4/4) thin clay films on faces of peds and lining voids; thick (¼ to ½ inch), brown (7.5YR 5/2) and gray (10YR 6/1) clay fills extend vertically between prismatic peds; light-gray (10YR 7/1) silt coatings and vertical streaks on many prism faces; very strongly acid; clear, wavy boundary.

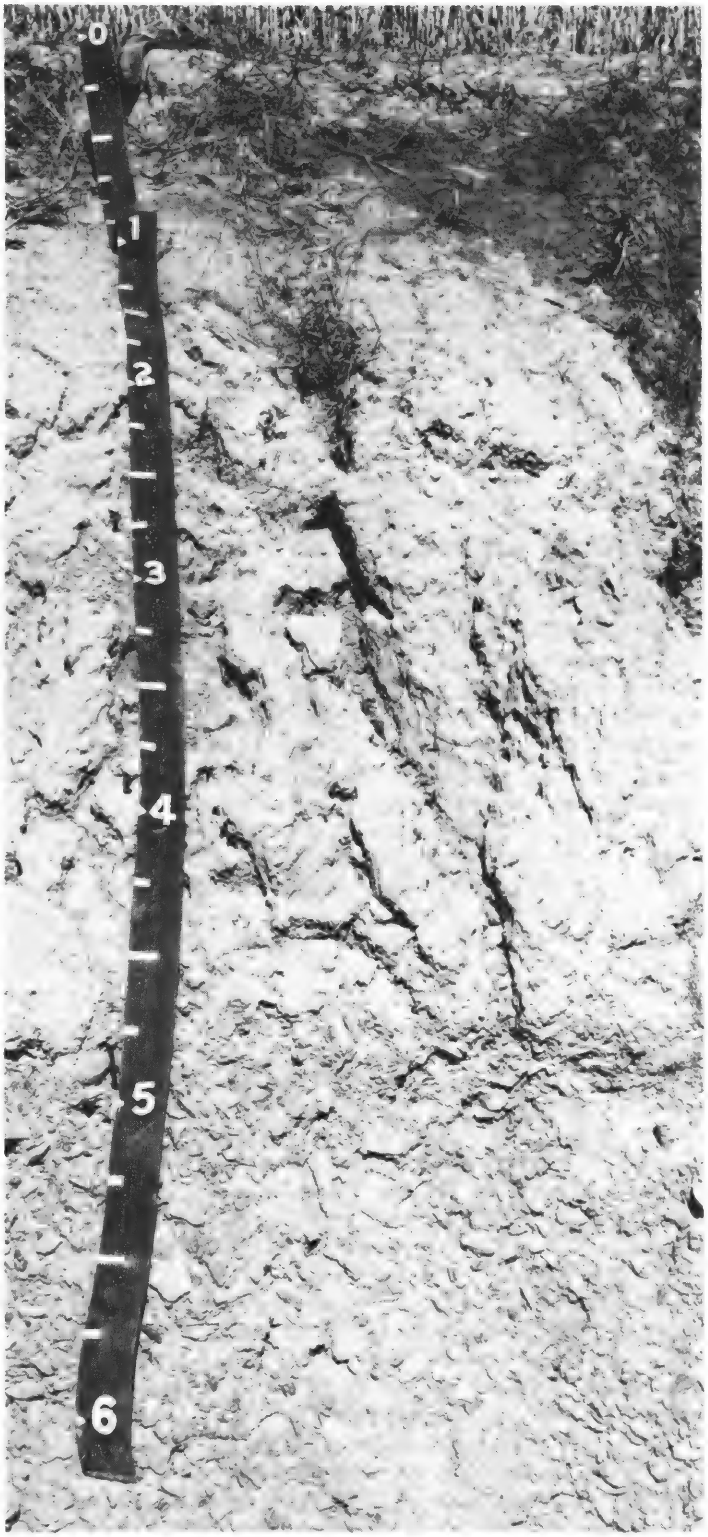

Figure 6.—**Representative profile of a Zanesville soil.**

IIB3—44 to 76 inches, strong-brown (7.5YR 5/6) silty clay; common, medium, distinct, gray (10YR 6/1) and dark reddish-brown (2.5YR 3/4) mottles; moderate, fine, angular blocky structure; firm; few small fragments of shale; strongly acid; clear, wavy boundary.

C—76 inches, stratified, weathered clay shale.

The Ap horizon ranges from dark brown or dark grayish brown to dark yellowish brown. The upper part of the B horizon ranges from yellowish brown to dark brown and strong brown, and the fragipan ranges from light gray to yellowish brown or dark yellowish brown. The B horizon is mostly silt loam to silty clay loam. In some places where these soils are underlain by clay shale, however, texture in the lower part of the B horizon ranges to silty clay. Except in severely eroded areas, where depth to the fragipan is as little as 16 inches, depth to the fragipan ranges from 20 to 30 inches. Thickness of the fragipan ranges from 10 to 36 inches, and thickness of the mantle of loess ranges from 18 to 45 inches. Bedrock of sandstone, siltstone, or shale is at a depth of 48 to 84 inches.

Zanesville soils are similar to Tilsit and Wellston soils. They are free of mottles to a greater depth than Tilsit soils. They have a fragipan, which Wellston soils lack.

Zanesville silt loam, 6 to 12 percent slopes, eroded (ZaC2).—This soil is on narrow ridges and on breaks adjacent to ridgetops. It has the profile described as representative of the series. Runoff is medium.

Included with this soil in mapping were small wooded areas where little erosion has taken place. Also included were a few small areas of reddish-brown, fine-textured soils that formed over thin beds of limestone.

If properly managed, this Zanesville soil is suited to most crops commonly grown in the county. It is not well suited to deep-rooted legumes, because the roots of those plants cannot penetrate the fragipan. Runoff and susceptibility to further erosion are the major limitations. In addition, the very slowly permeable fragipan confines most roots to the soil zone above the pan. Crops respond well to lime and fertilizer. Capability unit IIIe-7; woodland suitability group 3d9.

Zanesville silt loam, 6 to 12 percent slopes, severely eroded (ZaC3).—This soil is on narrow ridges and on breaks adjacent to ridgetops. It has a profile similar to the one described as representative of the series. In some places, however, the original surface layer has been removed by erosion and the fragipan is at a depth of only 16 to 24 inches. In many places dark-brown and yellowish-brown material from the subsoil is exposed. Small gullies occur in most areas. Runoff is medium.

Included with this soil in mapping were small areas of reddish-brown, fine-textured soils that formed in material weathered from thin beds of limestone. Also included were small areas of Gullied land and small areas of less eroded Zanesville soils.

This severely eroded Zanesville soil is suited to small grain, hay, and pasture, and it can be used occasionally for corn or soybeans. It is not well suited to deep-rooted legumes, because the roots of those plants cannot penetrate the fragipan. Runoff and susceptibility to further erosion are the major limitations. In addition, the very slowly permeable fragipan confines most roots to the soil zone above the pan. Crops respond well to lime and fertilizer. Capability unit IVe-7; woodland suitability group 3d9.

Use and Management of the Soils

This section provides information about the use and management of the soils of Crawford County for crops, woodland, and wildlife. It also gives facts about use of the soils for engineering purposes and for recreation.

Use of the Soils for Crops

In the following pages, the system of capability classification used by the Soil Conservation Service is explained and management practices needed for the commonly grown crops are described. In addition, predicted average yields of the principal crops are listed.

About a third of Crawford County is used for field crops and permanent pasture. Corn, soybeans, and wheat are the main cultivated crops. Clover, alfalfa, and grass are the main forage crops. For all areas used for crops, need for lime and fertilizer can be determined by testing the soils.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraph.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Crawford County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes. (None in Crawford County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Crawford County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–3 or IVe–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Crawford County are described and suggestions for the use and management of the soils are given. The names of soil series represented in the capability unit are named in the description of the unit, but this does not mean that all soils in a given series appear in the unit. To find the names of all of the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

Capability unit numbers are generally assigned locally but are part of a statewide system. All of the units in the system are not represented in Crawford County; therefore, the capability unit numbers in this soil survey are not consecutive.

CAPABILITY UNIT I–1

The only soil in this unit is Wheeling loam, 0 to 2 percent slopes. This soil is deep and well drained. It is on alluvial terraces.

Natural fertility and content of organic matter are low. Available water capacity is high, and permeability is moderate. The plow layer is strongly acid in areas that have not been limed.

This soil is well suited to all crops commonly grown in the county. It is used mainly for corn, soybeans, small grain, hay, and pasture.

Proper use of crop residue and green-manure crops provides organic matter. Crops respond well to fertilizer.

CAPABILITY UNIT I–2

This unit consists of deep, well-drained, medium-textured Cuba, Haymond, and Huntington soils. These nearly level soils are on bottom lands along streams throughout the county.

Natural fertility ranges from low to high, and content of organic matter is moderate. Available water capacity is high, and permeability is moderate. The plow layer is strongly acid to neutral in areas that have not been limed.

Soils of this unit are well suited to most crops commonly grown in the county. Occasional flooding is a hazard from December to June, however, and alfalfa and fall-planted small grain are subject to severe damage during periods of flooding. The main crops are corn, soybeans, hay, and pasture.

Proper use of crop residue and green-manure crops provides organic matter. Crops respond well to fertilizer.

CAPABILITY UNIT IIe–3

In this unit are deep, well-drained, medium-textured soils of the Alford, Crider, Elkinsville, and Wheeling series. These moderately eroded, gently sloping soils are on uplands and on terraces along streams.

Natural fertility and content of organic matter are low. Available water capacity is high, and permeability is moderate. The plow layer is strongly acid or medium acid in areas that have not been limed.

Runoff and susceptibility to further erosion are the major limitations that affect their use and management.

These soils are suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grain, hay, and pasture.

Keeping tillage to a minimum, tilling on the contour, and establishing grassed waterways and diversion terraces help to control runoff and erosion (fig. 7). Proper use of crop residue and green-manure crops provides organic matter. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IIe–7

This unit consists of deep, moderately well drained, medium-textured Pekin and Tilsit soils. These gently sloping soils are on uplands and on terraces along streams throughout the county.

Natural fertility and content of organic matter are

Figure 7.—**Structure used to control grade and prevent cutting on Elkinsville silt loam, 2 to 6 percent slopes, eroded, in capability unit IIe-3.**

low. Available water capacity is moderate, and permeability is very slow. A very firm and brittle fragipan in the subsoil restricts the downward movement of water and roots. The plow layer is strongly acid in areas that have not been limed.

Controlling erosion, providing organic matter, and maintaining or increasing fertility are the major concerns of management. Because the fragipan restricts the movement of water, these soils are often saturated in winter and spring and farming is delayed in spring. The soils are somewhat droughty during long dry periods in summer.

These soils are suited to most crops commonly grown in the county. They are not well suited to such deep-rooted plants as alfalfa, because the fragipan restricts the depth to which roots can penetrate. Corn, soybeans, small grain, hay (fig. 8), and pasture are the main crops.

Keeping tillage to a minimum and farming on the contour help to control erosion. Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves soil tilth. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IIw-2

The only soil in this unit is Henshaw silt loam, 0 to 3 percent slopes. This soil is deep and somewhat poorly drained. It occupies lacustrine terraces along streams.

Natural fertility and content of organic matter are low. Available water capacity is high, and permeability is moderately slow. The plow layer is medium acid in areas that have not been limed.

Wetness limits use of this soil and affects its management.

If properly drained, this soil is suited to most of the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops.

Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves soil tilth. A suitable drainage system is needed to reduce wetness. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IIw-3

The only soil in this unit is Bartle silt loam. This soil is somewhat poorly drained and nearly level. It is on alluvial terraces along streams throughout the county.

Natural fertility and content of organic matter are low. Available water capacity is moderate, and permeability is very slow. A very firm and brittle fragipan in the subsoil restricts the downward movement of water and roots. In areas that have not been limed, the plow layer is strongly acid.

Wetness limits use of this soil and affects its management. Because the fragipan restricts the movement

Figure 8.—**Round bales of fescue hay left in the field for winter grazing on Tilsit silt loam, 2 to 6 percent slopes, eroded, in capability unit IIe-7.**

of water, this soil is often saturated in winter and spring and farming is delayed in spring. This soil is somewhat droughty during long dry periods in summer.

If properly drained, this soil is suited to most crops commonly grown in the county. It is not well suited to such deep-rooted plants as alfalfa, because the fragipan restricts the penetration of roots. Corn, soybeans, small grain, hay, and pasture are the main crops.

Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves soil tilth. A suitable drainage system reduces wetness. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IIw-5

Only Tilsit silt loam, 0 to 2 percent slopes, is in this unit. This soil is deep and moderately well drained. It is on uplands throughout the county.

Natural fertility and content of organic matter are low. Available water capacity is moderate, and permeability is very slow. A very firm and brittle fragipan in the subsoil restricts the downward movement of water and roots. The plow layer is strongly acid in areas that have not been limed.

Wetness limits use of this soil and affects its management. Because the fragipan restricts the movement of water, this soil is often saturated in winter and spring and farming is delayed in spring. This soil is somewhat droughty during long dry periods in summer. This soil is suited to most crops commonly grown in the county. It is not well suited to such deep-rooted crops as alfalfa, because the fragipan restricts the penetration of roots. Corn, soybeans, small grain, hay, and pasture are the main crops.

Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves soil tilth. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IIw-7

The only soil in this unit is Wakeland silt loam. This soil is deep, somewhat poorly drained, and nearly level. It is on flood plains along streams.

Natural fertility is medium, and content of organic matter is low. Available water capacity is high, and permeability is moderate. The plow layer is slightly acid or neutral in areas that have not been limed.

Wetness limits use of this soil and affects its management. Flooding is a hazard from December to June.

If properly drained, this soil is suited to most crops commonly grown in the county. It is not well suited to alfalfa and fall-planted small grain, however, because those crops are subject to severe damage during periods of flooding. Corn, soybeans, hay, and pasture are the main crops.

Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves soil tilth. Crops respond well to lime and fertilizer. A suitable drainage system makes this soil less wet.

CAPABILITY UNIT IIs-6

The only soil in this unit is Burnside silt loam. This is a deep, well-drained, stony, nearly level soil. It is on flood plains along streams.

The content of organic matter is moderate. Natural fertility and available water capacity are low or moderate, and permeability is moderate. The plow layer is slightly acid or neutral in areas that have not been limed.

The many fragments of rock throughout the profile make this soil somewhat droughty during long dry periods in summer. In places the fragments of rock are so concentrated that they interfere with normal tillage. Occasional flooding is a hazard from December to June.

This soil is suited to most crops commonly grown in the county. Alfalfa and fall-planted small grain, however, are subject to severe damage during periods of flooding. Corn, soybeans, hay, and pasture are the main crops.

Proper use of crop residue and green-manure crops provides organic matter and increases fertility. Crops respond well to fertilizer.

CAPABILITY UNIT IIIe-3

This unit consists of well-drained, medium-textured, moderately sloping Crider, Elkinsville, Wellston, and Wheeling soils. In some places the Wellston soil is deep, and in others it is moderately deep. The other soils are deep. All of the soils are eroded.

Natural fertility and content of organic matter are low. Permeability is moderate. Available water capacity generally is high, but it is moderate where the Wellston soil is moderately deep. The plow layer is strongly acid in areas that have not been limed.

Runoff and susceptibility to further erosion are the major limitations.

Soils of this unit are suited to most crops commonly grown in the county. The main crops are corn, soybeans, small grain, hay, and pasture.

Keeping tillage to a minimum, farming on the contour, practicing stripcropping, installing diversion terraces and grassed waterways, and growing winter cover crops help to control runoff and erosion. Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves soil tilth. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IIIe-7

The only soil in this unit is Zanesville silt loam, 6 to 12 percent slopes, eroded. This soil is deep and well drained. It is on uplands throughout the county.

Natural fertility and content of organic matter are low. Available water capacity is moderate, and permeability is very slow. A very firm and brittle fragipan in the subsoil restricts downward movement of water and penetration of roots. The plow layer is strongly acid in areas that have not been limed.

Runoff and susceptibility to further erosion are the major limitations. Because the fragipan restricts the movement of water, this soil is often saturated in winter and spring and farming is delayed in spring. This soil is somewhat droughty during long dry periods in summer.

This soil is suited to most crops commonly grown in the county. It is not well suited to such deep-rooted crops as alfalfa, because the fragipan restricts the depth to which roots can penetrate. Corn, soybeans, small grain, hay, and pasture are the main crops.

Figure 9.—**Grassed waterway on Zanesville silt loam, 6 to 12 percent slopes, eroded.**

Keeping tillage to a minimum, cultivating on the contour, practicing stripcropping, establishing grassed waterways (fig. 9), and growing winter cover crops help to control runoff and erosion. Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves soil tilth. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IIIw-3

The only soil in this unit is Johnsburg silt loam. This soil is deep, somewhat poorly drained, and nearly level. It is on uplands throughout the county.

Natural fertility and content of organic matter are low. Available water capacity is moderate, and permeability is very slow. A very firm and brittle fragipan in the subsoil restricts the downward movement of water and the penetration of roots. The plow layer is strongly acid in areas that have not been limed.

Wetness is the major limitation of this soil. Because the fragipan restricts the movement of water, this soil is often saturated in winter and spring and farming is delayed in spring. This soil is somewhat droughty during long dry periods in summer.

If properly drained, this soil is suited to most crops commonly grown in the county. It is not well suited to such deep-rooted crops as alfalfa, because the fragipan restricts the depth to which roots can penetrate. Corn, soybeans, small grain, hay, and pasture are the main crops.

Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves tilth. A suitable drainage system reduces wetness. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IVe-3

This unit consists of well-drained, moderately sloping and strongly sloping Hagerstown and Wellston soils on uplands and terraces throughout the county. The moderately sloping soils are severely eroded, and the strongly sloping soils are moderately eroded. The Hagerstown soils are deep, and the Wellston soils are deep or moderately deep. Most of the soils in this unit have a medium-textured surface layer. The severely eroded Hagerstown soil, however, has a moderately fine textured surface layer that becomes cloddy if worked when wet.

Natural fertility and content of organic matter are low. Available water capacity is moderate or high, and permeability is moderate. The plow layer is strongly acid in areas that have not been limed.

Susceptibility to further erosion is the major limitation of these soils. Poor tilth is also a limitation in severely eroded areas.

Soils of this unit are suited to small grain, hay, and pasture. Corn or soybeans can be grown occasionally.

Keeping tillage to a minimum, cultivating on the contour, practicing stripcropping, installing diversion terraces and grassed waterways, and growing winter cover crops help to control runoff and erosion. Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves tilth. Crops respond well to lime and fertilizer.

CAPABILITY UNIT IVe-7

The only soil in this unit is Zanesville silt loam, 6 to 12 percent slopes, severely eroded. This soil is deep and well drained. It is on uplands throughout the county.

Natural fertility and content of organic matter are low. Available water capacity is moderate, and permeability is very slow. A very firm and brittle fragipan in the subsoil restricts the downward movement of water and the penetration of roots. The plow layer is strongly acid in areas that have not been limed.

Runoff and susceptibility to further erosion are the major limitations, but poor tilth is also a concern. Because the fragipan restricts the movement of water,

this soil is often saturated in winter and spring and farming is delayed in spring. This soil is somewhat droughty during long dry periods in summer.

This soil is suited to small grain, hay, and pasture. It is not well suited to such deep-rooted plants as alfalfa, because the fragipan restricts the depth to which roots can penetrate. Corn or soybeans can be grown occasionally.

Keeping tillage to a minimum, cultivating on the contour, practicing stripcropping, installing diversion terraces and grassed waterways, and growing winter cover crops help to control runoff and erosion. Proper use of crop residue and green-manure crops provides organic matter, increases fertility, and improves tilth. Crops respond well to lime and fertilizer.

CAPABILITY UNIT VIe-1

In this unit are well-drained, medium-textured or moderately fine textured, moderately sloping to very steep soils on terraces and uplands throughout the county. These soils are in the Alford, Gilpin, Hagerstown, Markland, Wellston, and Wheeling series. Most of these soils are deep, but the Gilpin soil and some areas of the Wellston soil are only moderately deep. All of these soils are eroded and some are severely eroded.

Natural fertility and content of organic matter are low. The Alford, Markland, and Wheeling soils and the deep areas of the Wellston soil have high available water capacity; the Hagerstown soils have moderate to high available water capacity; and the Gilpin soil and the moderately deep areas of the Wellston soil have moderate available water capacity. Most of the soils are moderately permeable, but the Markland soils are slowly permeable. In areas that have not been limed, the plow layer of the Markland soils is slightly acid or neutral and the plow layer of the other soils is medium acid or strongly acid.

Runoff and susceptibility to further erosion are the major limitations.

Soils of this unit are suited to permanent grass pasture.

Farming on the contour and keeping tillage to a minimum during preparation of the seedbed help to control runoff and erosion. Where the soils are severely eroded, manure and crop residue can be used to provide organic matter, and they also serve as a mulch in newly seeded areas. Controlling grazing helps to maintain a good cover of plants and thus reduces runoff and erosion. Pasture plants respond well to lime and fertilizer.

CAPABILITY UNIT VIIe-1

This unit consists of well-drained, medium-textured or moderately fine textured, strongly sloping to very steep Gilpin and Markland soils on terraces and uplands throughout the county. The Gilpin soil is moderately deep, and the Markland soils are deep. Some of the soils are severely eroded.

Natural fertility and content of organic matter are low. The Gilpin soil has moderate available water capacity and is moderately permeable. The Markland soils have high available water capacity and are slowly permeable. In areas that have not been limed, the plow layer of the Gilpin soil is medium acid or strongly acid and that of the Markland soils is slightly acid or neutral.

Runoff and susceptibility to further erosion limit the use of these soils. The soils should not be cultivated, but they are suited to trees and native grasses, which provide a permanent cover. Maintaining a permanent cover of grasses or trees helps to control runoff and erosion. Protection from overgrazing is needed in areas used for pasture.

CAPABILITY UNIT VIIe-2

This unit consists of well-drained, medium-textured, steep and very steep Berks, Corydon, Gilpin, and Weikert soils on uplands throughout the county. The Berks and Gilpin soils are moderately deep, and the Corydon and Weikert soils are shallow over bedrock.

Natural fertility is low, and content of organic matter is low or medium. The Berks and Gilpin soils have low or moderate available water capacity and moderate permeability. Both the Corydon and Weikert soils have very low available water capacity, but the Corydon soil has moderately slow permeability and the Weikert soil has moderately rapid permeability.

Runoff and susceptibility to erosion are the major limitations. The soils are suited to trees and should not be cultivated. Maintaining a permanent cover of trees helps to control runoff and erosion.

CAPABILITY UNIT VIIe-3

Only Quarries is in this unit. This land type consists mostly of limestone quarries, but it also includes a sandstone quarry located southeast of Taswell and a small abandoned strip mine southwest of Grantsburg. Spoil areas and exposed bedrock occupy all of the acreage.

Most places are bare, but in some places shrubs, weeds, and native grasses are starting to grow on the spoil. Trees can also be grown on the spoil. They help to stabilize the soil material, and they provide cover for wildlife.

CAPABILITY UNIT VIIe-4

Only Gullied land is in this unit. The soil material in this land type is underlain by bedrock at a depth of 4 to 6 feet. Bedrock is exposed at the bottom of the gullies in many places. Natural fertility and content of organic matter are very low.

Shrubs, weeds, and native grasses are starting to grow in some areas, but this land type is bare in most places. It is suited to grasses, trees, and shrubs. These plants help to stabilize the soil material, help to control runoff, and provide cover for wildlife. Many of the ridges between gullies are suitable for growing Christmas trees.

Predicted yields

Table 2 shows, for each mapping unit in the county, the average yields per acre of the principal crops. The yields indicated are those to be expected at two levels of management. Yields in columns A are those to be expected under an average, or medium, level of management. Yields in columns B are those to be expected under an improved, or high, level of management.

TABLE 2.—*Predicted average yields per acre of principal crops on arable soils*

[Yields in columns A can be expected under an average level of management; those in columns B can be expected under a high level of management. Dashes indicate that the crop is not grown or is not suited to the soil specified]

Soil	Corn		Soybeans		Wheat		Mixed hay			
							Alfalfa and grass		Clover and grass	
	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*
Alford silt loam, 2 to 6 percent slopes, eroded	80	105	25	40	30	45	3.5	4.5	2.5	3.5
Alford silt loam, 12 to 25 percent slopes, eroded	----	----	----	----	15	25	2.5	3.5	1.5	2.5
Bartle silt loam	70	100	25	35	30	40	1.5	2.5	2.0	3.0
Berks-Gilpin-Weikert complex, 25 to 75 percent slopes	----	----	----	----	----	----	----	----	----	----
Burnside silt loam	70	90	20	30	----	----	3.0	4.5	2.5	3.0
Corydon stony silt loam, 20 to 60 percent slopes	----	----	----	----	----	----	----	----	----	----
Crider silt loam, 2 to 6 percent slopes, eroded	80	110	30	45	30	40	4.0	5.0	3.0	4.0
Crider silt loam, 6 to 12 percent slopes, eroded	70	90	25	35	25	35	3.5	4.5	2.5	3.5
Cuba silt loam	80	120	30	45	----	----	4.0	5.0	3.0	3.5
Elkinsville silt loam, 2 to 6 percent slopes, eroded	80	110	30	45	30	40	4.0	5.0	3.0	4.0
Elkinsville silt loam, 6 to 12 percent slopes, eroded	70	90	25	35	25	35	3.5	4.5	2.5	3.5
Gilpin silt loam, 18 to 25 percent slopes, eroded	----	----	----	----	----	----	2.0	2.8	1.5	2.3
Gilpin silt loam, 18 to 25 percent slopes, severely eroded	----	----	----	----	----	----	2.0	2.3	1.5	2.0
Gilpin-Berks complex, 18 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----
Gullied land	----	----	----	----	----	----	----	----	----	----
Hagerstown silt loam, 12 to 18 percent slopes, eroded	65	85	20	30	25	35	3.0	4.0	2.0	3.0
Hagerstown silt loam, 18 to 25 percent slopes, eroded	----	----	----	----	16	23	2.0	2.5	1.5	2.0
Hagerstown silty clay loam, 6 to 12 percent slopes, severely eroded	65	85	20	30	25	35	3.0	4.0	2.0	3.0
Hagerstown silty clay loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	16	23	2.0	2.5	1.5	2.0
Haymond silt loam	85	120	35	45	----	----	4.0	5.0	3.0	3.5
Henshaw silt loam, 0 to 3 percent slopes	70	100	30	40	30	40	3.0	4.0	1.7	2.7
Huntington silt loam	90	120	35	45	----	----	4.0	5.0	3.0	3.5
Johnsburg silt loam	65	95	25	35	30	40	1.5	2.5	2.0	3.0
Markland silt loam, 12 to 18 percent slopes, eroded	----	----	----	----	15	23	2.5	3.0	1.5	2.5
Markland silt loam, 25 to 70 percent slopes	----	----	----	----	----	----	1.5	2.5	1.0	1.5
Markland silty clay loam, 6 to 12 percent slopes, severely eroded	----	----	----	----	15	23	2.5	3.0	1.5	2.5
Markland silty clay loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	2.0	2.5	1.5	2.0
Pekin silt loam, 2 to 6 percent slopes	60	90	25	35	30	40	2.5	3.5	2.0	3.0
Quarries	----	----	----	----	----	----	----	----	----	----
Tilsit silt loam, 0 to 2 percent slopes	65	95	30	40	30	40	2.5	3.5	2.0	3.0
Tilsit silt loam, 2 to 6 percent slopes, eroded	60	85	25	35	30	40	2.5	3.5	2.0	3.0
Wakeland silt loam	80	105	25	35	----	----	2.5	3.5	2.0	2.5
Wellston silt loam, 6 to 12 percent slopes, eroded	55	80	20	30	25	35	3.5	4.0	2.5	3.0
Wellston silt loam, 6 to 12 percent slopes, severely eroded	50	75	17	25	20	30	3.0	3.5	2.0	2.5
Wellston silt loam, 12 to 18 percent slopes, eroded	45	70	15	22	18	25	2.5	3.0	2.0	2.5
Wellston silt loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	15	20	2.0	2.5	1.5	2.0
Wheeling loam, 0 to 2 percent slopes	85	115	35	45	35	45	4.0	5.0	3.0	4.0
Wheeling loam, 2 to 6 percent slopes, eroded	80	110	30	46	30	40	4.0	5.0	3.0	4.0
Wheeling loam, 6 to 12 percent slopes, eroded	70	100	25	35	25	35	3.5	4.5	2.5	3.5
Wheeling loam, 12 to 25 percent slopes, eroded	----	----	----	----	----	----	1.5	2.5	1.0	2.0
Zanesville silt loam, 6 to 12 percent slopes, eroded	55	80	20	25	20	30	2.5	3.5	1.7	2.5
Zanesville silt loam, 6 to 12 percent slopes, severely eroded	45	70	15	20	20	30	2.0	3.0	1.5	2.0

Average management consists of—

1. Using a cropping system that maintains satisfactory tilth and an adequate content of organic matter.
2. Controlling erosion sufficiently to prevent serious reduction in the quality of the soil.
3. Applying moderate amounts of fertilizer and lime where need is indicated by soil tests.
4. Returning most of the crop residue to the soil.
5. Using conventional methods for plowing and tilling.
6. Planting varieties of crops that are generally adapted to the climate and the soils.
7. Controlling weeds fairly well by tillage and use of chemical sprays.
8. Draining wet areas enough for cropping but not always enough to prevent lower yields.

A high level of management consists of—

1. Using a cropping system that maintains satisfactory tilth and an adequate content of organic matter.
2. Controlling erosion to the maximum extent feasible so that the quality of the soil is maintained or improved rather than reduced.
3. Maintaining a high level of fertility by means of soil tests and use of fertilizer in accordance

with recommendations of the State Agricultural Experiment Station.
4. Liming the soils in accordance with the results of soil tests.
5. Using crop residue to the fullest extent practicable to protect and improve the soil.
6. Practicing minimum tillage, where needed, to prevent compaction and to help to control erosion.
7. Using only the varieties of crops that are best suited to the climate and soil.
8. Controlling weeds carefully by tillage and spraying.
9. Draining wet areas well enough so that wetness does not restrict yields of adapted crops.

Yields shown in table 2 are estimated average yields for a period of 5 to 10 years. They are based on farm records, on interviews with farmers and members of the staff of the Purdue Agricultural Experiment Station, and on direct observations by soil scientists and soil conservationists. Considered in making the yield estimates were the prevailing climate, the characteristics of the soils, and the influence of different kinds of management on the soils.

These yield figures are not intended to apply directly to a specific tract of land for any particular year, because the soils vary somewhat from place to place, management practices differ from farm to farm, and weather conditions vary from year to year. Nevertheless, these estimates appear to be as accurate a guide as can be obtained without detailed and lengthy investigation. They are useful in showing the relative productivity of the soils and how soils respond to different levels of management.

Use of the Soils as Woodland [2]

When settlers arrived in the area that is now Crawford County, the plant cover was mainly hardwood trees. The settlers soon cleared much of the area for farming. In many places they removed the trees with little regard for the kind of soil and the steepness of the slope. By 1969, only 97,454 acres of woodland remained in the county.

In some cleared areas, severe erosion damaged the soils, reduced yields, and caused many fields and farms to be abandoned. In 1969, reforestation to control erosion and to establish a cover of trees was needed on an estimated 16,400 acres.

Some areas under Federal or State control are protected. Of these, the Hoosier National Forest and the Harrison-Crawford State Forest are well managed and provide a supply of raw material for local wood-using industries. Timber from these public forests supplements the supply available from privately owned woodland.

Properties of the soils strongly influence adaptation of species of trees, the growth of trees, and the woodland management needed for a particular site. Good management increases the productivity of woodland and increases such other benefits as protection to the watershed, habitat for wildlife, esthetic values, and sites for recreation. Depth and texture of the soils affect the available water capacity, and they thereby influence the growth of trees. Other important soil properties are soil aeration, depth of the root zone, natural drainage and depth to the water table, thickness of the surface layer, texture and consistency of the soil material, available plant nutrients, and content of rock.

Woodland cover types

For management purposes the woodland cover in Crawford County can be divided into five major types, based mainly on the predominant kind of tree or group of trees on the site. Following are descriptions of these major woodland types.

Upland oak is the main woodland cover type in this county. It occupies most of the steep soils and the dry, shallow soils that have a southern exposure. Composition of the stand is mainly white, black, red, scarlet, and chinquapin oaks, but hickory, ash, sugar maple, tulip-poplar, and redcedar are mixed with the oaks.

Tulip-poplar is a cover type that generally occurs at the lower elevations on slopes that face north and northeast, and it is also in narrow valleys or coves. Tulip-poplar produces valuable wood, and it is generally favored in management. In this woodland type, white oak, red oak, hickory, beech, ash, black walnut, sugar maple, and basswood grow in association with tulip-poplar.

Pin oak is a cover type on poorly drained soils and on soils that have a high water table. Red maple, sweetgum, swamp white oak, river birch, ash, and hickory are mixed with the pin oak.

Sweetgum is a cover type on sites similar to those occupied by pin oak, but it is generally dominant where sweetgum has invaded in abandoned fields of wet soils. Red maple, river birch, ash, hickory, and sycamore are mixed with the sweetgum in this type.

Mixed pine is a cover type that was established through planting rather than through natural regeneration. Pines were planted to help to control erosion on sites no longer suitable for hardwoods. The mixed pine cover type in Crawford County is made up of Virginia, shortleaf, white, and red pines.

Woodland suitability groups

To assist landowners in using their soils for producing wood crops, the soils of Crawford County have been placed in 13 woodland suitability groups. Each group consists of soils that are suited to the same kind of trees, that require about the same kind of management, and that have about the same potential productivity. Potential productivity refers to the capability of a soil or group of soils to produce wood crops.

Each suitability group is identified by a three-part symbol, made up of Arabic numerals and a lowercase letter. Examples are 1o1, 3w5, and 5r14. The first Arabic numeral indicates relative potential productivity of the soils in the group. The numeral 1 means *very high* relative potential productivity; 2, *high;* 3,

[2] By JOHN C. HOLWAGER, woodland conservationist, Soil Conservation Service.

moderately high; 4, *moderate;* and 5, *low*. The best indicator of soil productivity is the average height to which the tallest trees grow in a stated number of years. This average height, in feet for a specified age, is called *site index*. For species studied in this county, the site index is based on the average height of trees at age 50 years. Site indexes can be grouped into productivity classes, and these classes, in turn, can be converted to expected annual yields (*3*, *4*).

The second element of the suitability symbol is a lowercase letter that refers to a soil characteristic that limits use or affects management of the woodland. In this county recognized hazards are represented by the letters *c*, *o*, *r*, *s*, and *w*, which have the following meanings: *c*, clay in the upper part of the soil; *o*, no significant soil-related hazards or limitations; *r*, relief or steepness of slope is the main limitation; *s*, soils are sandy and dry and are low in content of plant nutrients and in available water capacity; and *w*, excessive wetness, seasonally or year round.

The third element of the suitability symbol, one or more Arabic numerals, is an identification number that is generally assigned locally but is part of a statewide system. Not all of the units of the system are represented in Crawford County. Therefore, the numbers are not consecutive.

In table 3 the site index for each major woodland cover type, hazards that affect management, and preferred species are shown by woodland suitability groups of soils. Also in table 3, the soils of each woodland group are rated according to the kind and degree of hazards or limitations that affect management. Hazards and limitations that are rated are hazards of erosion, equipment limitation, seedling mortality, windthrow, and plant competition.

The woodland suitability group for any soil can be found by referring to the "Guide to Mapping Units" at the back of the survey.

Erosion hazard refers to potential soil losses that may occur in wooded areas. The hazard is rated as *slight* if expected soil losses are small; *moderate* if some losses are expected and care must be used to prevent losses; and *severe* if special methods must be used to minimize soil losses. In well-stocked woodland in Crawford County, only the steep and very steep soils are subject to severe erosion.

Equipment limitation is influenced by such soil characteristics as slope, depth to water table, drainage, texture of the surface layer, and stoniness, which restrict or prohibit use of heavy equipment for building roads in wooded areas and for tending and harvesting wood crops. A rating of *slight* means that there is no restriction in the kind of equipment and in the time of year it can be used; *moderate* means that the use of heavy equipment is restricted for less than 3 months each year; and *severe* means that the use of heavy equipment is restricted for more than 3 months each year.

Seedling mortality refers to the expected loss of planted tree seedlings and is influenced by such soil characteristics as natural drainage, depth to water table, susceptibility to flooding, soil depth and structure, and degree of erosion. In determining ratings for seedling mortality, plant competition is not considered and it is assumed that rainfall is adequate and that suitable planting stock and planting methods are used. A rating of *slight* means that the expected loss is less than 25 percent; *moderate* means that the expected loss is 25 to 50 percent; and *severe* means that the expected loss exceeds 50 percent. If the rating is moderate or severe, replanting is likely to be necessary to insure a fully stocked stand and special preparation of the seedbed and special planting techniques are likely to be required.

Windthrow refers to the hazard of trees being blown over by wind of high velocity. The ability of the tree to withstand wind is reflected by the soil characteristics that influence the development of the root system of the tree. The rating is *slight* if effective root depth is more than 20 inches and if the tree can withstand most winds; *moderate* if effective root depth is 10 to 20 inches and some trees are blown down during periods when the soil is excessively moist and the wind is strong; and *severe* if the effective root depth is 10 inches or less and isolated trees are blown down by strong winds.

Plant competition refers to the extent that undesirable plants are expected to invade where openings have been made in the canopy. Plant competition is influenced by such soil characteristics as natural drainage, available plant nutrients, available water capacity, and past damage from erosion. A rating of *slight* means that competition from other plants is not a problem; *moderate* means that plant competition delays development of a fully stocked stand of desirable trees; and *severe* means that plant competition prevents establishment of a stand of desirable trees unless weeding and intensive preparation of the site are used to control unwanted plants.

Use of the Soils for Wildlife

The soils, climate, relief, vegetation, and other elements of the environment are favorable for the development of wildlife habitat in Crawford County. Three main kinds of wildlife are recognized in this county—open-land wildlife, woodland wildlife, and wetland wildlife. The potential for development of a suitable habitat for open-land and woodland wildlife is high throughout most of the county. Only small local areas are suited to habitat needed for wetland wildlife.

In table 4 the soils of Crawford County are rated according to their suitability for providing habitat for each of the three main kinds of wildlife. Where the rating is other than *well suited*, the soil limitation is indicated. A rating of *well suited* means that a suitable habitat is easily created, improved, or maintained and that few or no soil limitations affect management. A rating of *suited* indicates that a suitable habitat can generally be created, improved, or maintained but that moderate soil limitations affect management. *Poorly suited* means that a suitable habitat can generally be created, improved, or maintained but that severe limitations affect management. A rating of *unsuited* indicates that it is doubtful that a suitable habitat can be

created, improved, or maintained, or that it is impractical to do so under the prevailing conditions.

The three main kinds of wildlife in the county are defined in the following paragraphs.

Open-land wildlife consists of birds, mammals, and reptiles that normally inhabit fields, pastures, and areas overgrown by grasses, herbs, and shrubs that are used for hay. Examples are rabbit, red fox, skunk, quail, and meadowlark. Suitability of the soils for this kind of wildlife is determined by their capability to produce such food and cover plants as seed and grain crops, grasses and legumes, wild herbaceous upland plants, and hardwoods.

Woodland wildlife consists of mammals and birds that inhabit areas covered by hardwoods and conifers, shrubs, and mixtures of these plants. Examples are squirrel, deer, raccoon, woodpecker, and nuthatch. Suitability of the soils for this kind of wildlife is determined by their capability to produce such food and cover plants as grasses and legumes, wild herbaceous upland plants, hardwoods, and conifers.

Wetland wildlife consists of mamals, birds, and reptiles that live in ponds, marshes, and swamps. Examples are muskrat, wild duck, geese, kingfisher, and red-winged blackbird. Suitability of the soils for this kind of wildlife is determined by capability to produce wetland food and cover plants and seed and grain crops. It is also based on limitations to use of the soils for shallow water developments and excavated ponds.

Engineering Uses of the Soils [3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissioners, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compaction characteristics, natural drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, drainage systems, ponds and small dams, and systems for the disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select and develop sites for industrial, business, residential, and recreational uses.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables and plan detailed surveys of the soils at the site.
3. Plan and design farm drainage systems, farm ponds, diversion terraces, and other structures for soil and water conservation.
4. Locate possible sources of sand and gravel.
5. Correlate performance of engineering structures with soil mapping units to develop information that can be useful in designing and maintaining such structures.
6. Determine trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Use this information to supplement that obtained from published maps, reports, and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is in tables 5, 6, and 7, which show, respectively, results of engineering laboratory tests on soil samples; several estimated soil properties significant to engineering; and interpretations for various engineering uses. At many construction sites, major variations in the soil characteristics occur within the depth of the proposed excavation, and several kinds of soil may occur within short distances. Specific laboratory data on engineering properties of the soil at the site should be obtained before planning detailed engineering work.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or excavations deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used in this publication have a special meaning to soil scientists that is not known to all engineers. The Glossary at the back of this publication defines many of these terms.

Engineering classification systems

The two systems most commonly used in classifying soils for engineering are the AASHO system, adopted by the American Association of State Highway Officials (AASHO), and the Unified system, used by SCS engineers, the Department of Defense, and others.

The AASHO system *(1)* is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. The best materials for use in highway subgrade (gravelly soils of high bearing capacity) are classified as A–1, and the poorest (clayey soils having low strength when wet) are classified as A–7. As additional refinement, the relative engineering effect of the fine-grained soils within each group can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest.

[3] PETER FORSYTHE, assistant State conservation engineer, Soil Conservation Service, assisted in the preparation of this section.

TABLE 3.—*Site indexes, hazards, and limitations that affect management,*

Woodland suitability group, description of soils, and mapping units in group	Site index for—			
	Upland oaks	Tulip-poplar	Pin oak	Sweet-gum
Group 1r2: Deep, well-drained, strongly sloping or moderately steep soils that have high available water capacity. WhE2.	85–95	95–105	(1)	(1)
Group 1o1: Deep, well-drained, nearly level to moderately steep soils that generally have high available water capacity. Hagerstown soils have moderate or high available water capacity. AfB2, AfE2, CrB2, CrC2, ElB2, ElC2, HaD2, HgC3, HgD3, WhA, WhB2, WhC2.	85–95	90–105	(1)	(1)
Group 1o8: Deep, well-drained, nearly level soils on flood plains; generally have high available water capacity. Burnside soils have low or moderate available water capacity. Bu, Cu, Hm, Hu.	(1)	95–105	(1)	(1)
Group 2w13: Deep, somewhat poorly drained, nearly level soils on flood plains; high available water capacity. Wa.	85–95	85–95	(1)	80–90
Group 2r6: Deep, well-drained, moderately steep soils that have moderate or high available water capacity. HaE2.	75–79	75–85	(1)	(1)
Group 3w5: Deep, somewhat poorly drained, nearly level soils that generally have moderate available water capacity. Henshaw soil has high available water capacity. Ba, HnA, Jo.	70–80	80–90	80–90	75–85
Group 3d7: Shallow, well-drained, moderately steep to very steep soils that have very low available water capacity. CoF.	65–75	80–90	(1)	(1)
Group 3d9: Deep, well drained and moderately well drained, nearly level to moderately sloping soils that have moderate available water capacity. PeB, TlA, TlB2, ZaC2, ZaC3.	70–80	85–95	(1)	(1)
Group 3r12: Shallow and moderately deep, well-drained, moderately steep to very steep soils that have very low to moderate available water capacity. BgF, GpE.	70–80	70–80	(1)	(1)
Group 3r18: Deep, well-drained, moderately sloping to very steep soils that have high available water capacity. MaD2, MaF, McC3, McD3.	70–80	85–95	(1)	(1)
Group 3o10: Deep and moderately deep, well-drained, moderately sloping to moderately steep soils that have moderate available water capacity. Wellston soils have moderate or high available water capacity. GlE2, GlE3, WeC2, WeC3, WeD2, WeD3.	70–80	90–100	(1)	(1)
Group 4r16: Quarries make up this suitability group. Their characteristics are variable within short distances. Qu.	(1)	(1)	(1)	(1)
Group 5r14: Gullied land makes up this suitability group. Soil characteristics are variable within short distances. Gu.	(1)	(1)	(1)	(1)

1 The cover type does not generally grow on the soils of the stated woodland suitability group.
2 This group of preferred species should be planted where soil reaction pH is 5.5 to 7.0.

and preferred species by woodland suitability groups of soils

Kind and degree of hazards or limitations that affect management					Species preferred—	
Erosion hazard	Equipment limitation	Seedling mortality	Windthrow	Plant competition	In existing stands	For planting
Moderate	Moderate or severe.	Slight	Slight	Moderate	Red and white oaks, tulip-poplar, white ash, black walnut, sugar maple.	White and red pines, black walnut, tulip-poplar, black locust.
Slight	Slight	Slight	Slight	Moderate	Red and white oaks, white ash, tulip-poplar, black walnut, sugar maple.	White and red pines, black walnut, black locust, tulip-poplar, white ash.
Slight	Slight	Slight	Slight	Moderate	Cottonwood, sycamore, tulip-poplar, black walnut, white ash.	White pine, black walnut, tulip-poplar, black locust.
Slight	Moderate	Slight	Moderate	Moderate	Sweetgum, red maple, swamp chestnut oak, pin oak, tulip-poplar.	White pine, bald cypress, sycamore, red maple, white ash.
Moderate	Moderate	Slight	Slight	Moderate	Red and white oaks, tulip-poplar, white ash.	White, red, and shortleaf pines; tulip-poplar; black walnut; white ash.
Slight	Moderate	Slight	Slight	Moderate	White ash, red maple, bur and pin oaks, tulip-poplar, sweetgum.	White pine, bald cypress, white ash, red maple, tulip-poplar, sycamore.
Moderate	Moderate	Severe	Moderate	Moderate	Red, white, and chinquapin oaks; tulip-poplar; white ash.	White, red, and Virginia pines; tulip-poplar; black walnut.
Slight to moderate.	Slight	Slight	Moderate	Slight	White and chestnut oaks, white ash, tulip-poplar.	White, red, shortleaf, and Virginia pines; tulip-poplar; white ash.
Moderate	Severe	Moderate	Moderate	Slight	White, red, and black oaks; tulip-poplar; white ash.	White, red, and Virginia pines.
Moderate	Moderate	Slight	Slight	Moderate	White, black, bur, and swamp chestnut oaks; tulip-poplar.	White and red pines, tulip-poplar, white ash.
Slight to moderate.	Slight to moderate.	Slight	Slight	Moderate	White, black, and red oaks; tulip-poplar; white ash	White, red, and shortleaf pines; tulip-poplar; white ash.
Moderate	Severe	Slight	Slight	Slight	Cottonwood, sycamore, red maple, green ash.	[2]A: Sweetgum, tulip-poplar, sycamore, black alder, cottonwood. [3]B: Sycamore; sweetgum; river birch; white, jack, pitch, and Virginia pines.
Severe	Severe	Moderate	Moderate	Slight	Established through planting.	Virginia, shortleaf, and pitch pines.

[3] This group of preferred species should be planted where soil reaction is pH 4.0 to 5.5.

TABLE 4.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*

Soil series and map symbols	Kinds of wildlife		
	Open-land	Woodland	Wetland
Alford: AfB2, AfE2	Well suited where slopes are 2 to 6 percent. Suited where slopes are 12 to 25 percent: erodible; limitation is severe or very severe for grain and seed crops and moderate for grasses and legumes.	Well suited where slopes are 2 to 6 percent. Suited where slopes are 12 to 25 percent: erodible; limitation is moderate for grasses and legumes.	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Bartle: Ba	Well suited	Suited: somewhat poorly drained; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Suited: somewhat poorly drained; limitation is moderate for wetland food and cover plants and for excavated ponds and shallow water developments.
Berks: BgF. For Gilpin and Weikert parts of BgF, see those series.	Poorly suited: erodible; limitation is very severe for seed and grain crops and moderate for grasses and legumes.	Suited: erodible; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Unsuited: well drained; limitation is very severe for wetland food and cover plants, for seed and grain crops, and for excavated ponds and shallow water developments.
Burnside: Bu	Well suited	Well suited	Unsuited: well drained; limitation is severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Corydon: CoF	Poorly suited: erodible; limitation is very severe for seed and grain crops, severe for grasses and legumes, and moderate for wild herbaceous upland plants and nonconiferous woody plants.	Suited: erodible; limitation is severe for grasses and legumes and moderate for wild herbaceous upland plants and coniferous and nonconiferous woody plants.	Unsuited: well drained; limitation is very severe for wetland food and cover plants, for seed and grain crops, and for excavated ponds and shallow water developments.
Crider: CrB2, CrC2	Well suited	Well suited	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Cuba: Cu	Well suited	Well suited	Unsuited: well drained; limitation is severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Elkinsville: ElB2, EC2	Well suited	Well suited	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Gilpin: GlE2, GlE3, GpE. For Berks part of GpE, see Berks series.	Suited: erodible; limitation is very severe for seed and grain crops and moderate for grasses and legumes.	Suited: erodible; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for shallow water developments and excavated ponds.
Gullied land: Gu. Material is too variable for valid estimates.			
Hagerstown: HaD2, HaE2, HgC3, HgD3.	Well suited where slopes are 6 to 12 percent. Suited where slopes are 12 to 25 percent: erodible; limitation is very severe for seed and grain crops and moderate for grasses and legumes.	Well suited where slopes are 6 to 12 percent. Suited where slopes are 12 to 25 percent: erodible; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Unsuited: well drained; limitation is very severe for wetland food and cover plants, for shallow water developments and excavated ponds, and for seed and grain crops.
Haymond: Hm	Well suited	Well suited	Unsuited: well drained; limitation is severe for wetland food and cover plants and for excavated ponds and shallow water developments.

TABLE 4.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Kinds of wildlife — Open-land	Woodland	Wetland
Henshaw: HnA	Well suited	Suited: somewhat poorly drained; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Suited: slopes of 0 to 3 percent; somewhat poorly drained; limitation is moderate for wetland food and cover plants and for excavated ponds and shallow water developments.
Huntington: Hu	Well suited	Well suited	Unsuited: well drained; limitation is severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Johnsburg: Jo	Well suited	Suited: somewhat poorly drained; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Suited: somewhat poorly drained; limitation is moderate for wetland food and cover plants, for excavated ponds and shallow water developments, and for seed and grain crops. ponds.
Markland: MaD2, MaF, McC3, McD3	Well suited where slopes are 6 to 12 percent. Suited where slopes are 12 to 18 percent: erodible; limitation is severe for grain and seed crops and moderate for grasses and legumes. Poorly suited where slopes are 25 to 70 percent: erodible; limitation is severe for grasses and legumes and very severe for seed and grain crops.	Well suited where slopes are 6 to 12 percent. Suited where slopes are 12 to 18 percent: erodible; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure. Poorly suited where slopes are 25 to 70 percent: erodible; limitation is moderate for hardwoods; limitation is severe for conifers because of rapid growth and canopy closure and severe for grasses and legumes.	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Pekin: PeB	Well suited	Well suited	Unsuited: slopes of 2 to 6 percent; moderately well drained; limitation is very severe for wetland food and cover plants and for shallow water developments and severe for excavated ponds.
Quarries: Qu Material too variable for valid ratings.			
Tilsit: TlA, TlB2	Well suited	Well suited	Poorly suited where slopes are 0 to 2 percent; moderately well drained; limitation is severe for wetland food and cover plants and for excavated ponds and shallow water developments. Unsuited where slopes are 2 to 6 percent; moderately well drained; limitation is very severe for wetland food and cover plants and for shallow water developments and severe for excavated ponds.
Wakeland: Wa	Well suited	Suited: somewhat poorly drained; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Suited: somewhat poorly drained; limitation is moderate for wetland food and cover plants, for shallow water developments, and for seed and grain crops and severe for excavated ponds.
Weikert Mapped only in a complex with Berks and Gilpin soils.	Poorly suited: erodible; limitation is very severe for seed and grain crops, severe for grasses and legumes, and moderate for hardwoods and wild herbaceous upland plants.	Suited: erodible; limitation is severe for grasses and legumes and moderate for wild herbaceous upland plants and for hardwood and coniferous plants.	Unsuited: well drained; limitation is very severe for wetland food and cover plants, for excavated ponds and shallow water developments, and for seed and grain crops.

TABLE 4.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Kinds of wildlife		
	Open-land	Woodland	Wetland
Wellston: WeC2, WeC3, WeD2, WeD3.	Well suited where slopes are 6 to 12 percent. Suited where slopes are 12 to 18 percent: erodible; limitation is severe for seed and grain crops and moderate for grasses and legumes.	Well suited where slopes are 6 to 12 percent. Suited where slopes are 12 to 18 percent: erodible; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth and canopy closure.	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Wheeling: WhA, WhB2, WhC2, WhE2.	Well suited where slopes are 0 to 12 percent. Suited where slopes are 12 to 25 percent: erodible; limitation is moderate for grasses and legumes and severe to very severe for seed and grain crops.	Well suited where slopes are 0 to 12 percent. Suited where slopes are 12 to 25 percent: erodible; limitation is moderate for grasses and legumes; limitation is severe for conifers because of rapid growth rate and canopy closure.	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for excavated ponds and shallow water developments.
Zanesville: ZaC2, ZaC3	Well suited	Well suited	Unsuited: well drained; limitation is very severe for wetland food and cover plants and for excavated ponds and shallow water developments.

TABLE 5.—*Engineering*

[Tests performed by Soils and Pavement Design Laboratory, Joint Highway Research Project, School of Civil Engineering, Purdue merce, Bureau of Public Roads (BPR), in accordance with standard methods

Soil name and location	Parent material	SCS report No. S66 Ind–13–	Depth from surface	Moisture-density [1]		Mechanical analysis [2]	
				Maximum dry density	Optimum moisture	¾ inch	⅜ inch
			In	*Lb/cu ft*	*Pct*		
Cuba silt loam: SE¼ NW¼ sec. 31, T. 2 S., R. 2 W (Modal)	Alluvium.	7–1	0–10	96.3	24.5	----------	----------
		7–2	10–30	104.1	20.0	----------	----------
Hagerstown silty clay loam: NW¼ SE¼ sec. 10, T. 2 S., R. 2 E. (Modal)	Limestone.	6–1	0–8	101.4	21.5	----------	----------
		6–2	17–25	103.7	20.0	100	100
		6–3	25–42	94.2	26.5	----------	100
Johnsburg silt loam: SE¼ NW¼ sec. 36, T. 3 S., R. 1 E. (Modal)	Silty shale.	1–1	0–10	98.0	23.5	----------	----------
		1–2	24–36	102.0	21.2	----------	----------
		1–3	36–50	104.0	20.0	----------	----------
Wellston silt loam: NW¼ SE¼ sec. 27, T. 3 S., R. 1 E. (Nonmodal; underlain by clay shale).	Clay shale.	4–1	0–9	90.8	28.5	----------	----------
		4–2	24–33	111.2	16.5	94	94
		4–3	33–45	107.5	18.5	100	98
Zanesville silt loam: NW¼ SE¼ sec. 27, T. 3 S., R. 1 E. (Modal)	Clay shale.	3–1	0–9	89.7	29.5	----------	----------
		3–2	14–24	96.8	24.5	----------	----------
		3–3	24–44	107.5	18.5	----------	----------

[1] Based on AASHO designation T 99–57, Method A (*1*).

[2] Mechanical analyses according to AASHO designation T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including

In the Unified system *(9)*, soils are classified according to particle-size distribution, plasticity, liquid limit, and content of organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, SM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between classes are designated by symbols for both classes; for example, ML–CL.

AASHO and Unified classifications for tested soils in Crawford County are given in table 5. Estimated AASHO and Unified classifications for all of the soils mapped in the county are given in table 6.

Engineering test data

Table 5 contains test data for samples of soils in five of the major soil series in Crawford County. Selected layers of each soil were sampled, and the samples were tested by standard procedures in the laboratories of the Joint Highway Research Project at Purdue University, under the sponsorship of the Bureau of Public Roads. Mechanical analyses were made by a combination of sieve and hydrometer methods. These samples do not represent all of the soils of Crawford County or even the maximum range of characteristics of each series sampled, because not all the layers of each profile were sampled. The data resulting from the tests have been used, however, as a general guide for estimating the engineering properties of the soils of the county.

Table 5 provides information on the relationship between the moisture content and the density of soil when compacted. Compaction data are important in earthwork, because a soil is most stable if it is compacted to about its maximum dry density when it is at approximately the optimum moisture content. If the soil material is compacted at successively higher moisture content, assuming that the same amount of force is used in compacting the soil, the density of the compacted material increases until the *optimum moisture content* is reached. After that, the density decreases as the moisture content increases. The ovendry weight, in pounds per cubic foot, of the soil at the optimum moisture content is the *maximum dry density*.

test data

University, West Lafayette, Indiana, in cooperation with the Indiana State Highway Commission and the U.S. Department of Com-
of the American Association of State Highway Officials (AASHO) *(1)*]

Mechanical analysis [2]—Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than—							
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHO	Unified
								Pct			
----------	100	99	87	80	55	28	24	30	4	A–4(8)	ML
100	99	98	90	85	67	39	32	32	9	A–4(8)	CL–ML
----------	100	99	95	91	78	49	43	43	20	A–7–6(13)	CL
96	88	85	82	79	70	55	50	55	35	A–7–6(19)	CH
98	96	95	94	90	80	65	64	61	37	A–7–6(20)	CH
----------	100	99	93	89	74	29	20	33	4	A–4(8)	ML
----------	100	98	97	96	86	48	40	42	23	A–7–6(14)	CL
----------	----------	----------	100	98	85	45	36	31	10	A–4(8)	CL
100	98	96	89	85	72	33	24	37	9	A–4(8)	ML
91	86	83	76	73	61	35	29	32	13	A–6(9)	CL
95	92	89	79	75	64	34	28	30	11	A–6(9)	CL
----------	100	98	97	96	84	37	24	38	10	A–4(8)	ML
----------	100	99	98	97	83	44	37	39	14	A–6(10)	CL–ML
----------	100	98	91	88	75	40	31	30	12	A–6(9)	CL

that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses in this table are not suitable for naming textural classes of soils.

TABLE 6.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, for referring to another series in the first column of this table. The symbol > means more than; the symbol < means less than]

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface	Classification — USDA texture
	In	*Ft*	*In*	
Alford: AfB2, AfE2	60–120	>6	0–7	Silt loam
			7–50	Silt loam and light silty clay loam
			50–80	Silt loam, silt, and very fine sand
Bartle: Ba	>120	1–3	0–32	Silt loam
			32–72	Silt loam and silty clay loam
			72–87	Silt loam and silty clay loam
*Berks: BgF	20–36	>6	0–8	Channery silt loam
For Gilpin and Weikert parts, see their respective series.			8–24	Very channery silt loam
			24	Sandstone.
Burnside: Bu	>36	>6	0–12	Silt loam
			12–18	Channery silt loam
			18–26	Very channery silt loam
			26–60	Very channery loam
Corydon: CoF	10–20	>6	0–6	Stony silt loam
			6–12	Heavy silty clay loam
			12	Limestone.
Crider: CrB2, CrC2	60–120	>6	0–12	Silt loam
			12–25	Silty clay loam
			25–71	Silty clay to clay
			71	Limestone.
Cuba: Cu	>72	>6	0–56	Silt loam
			56–65	Stratified loam and silt loam
Elkinsville: ElB2, ElC2	>72	>6	0–14	Silt loam
			14–30	Heavy silt loam
			30–74	Stratified loam, clay loam, and sandy loam
*Gilpin: GlE2, GlE3, GpE	20–36	>6	0–16	Silt loam
For Berks part of GpE, see Berks series.			16–29	Silty clay loam
			29	Sandstone.
Gullied land: Gu. No valid estimates can be made.				
Hagerstown: HaD2, HaE2, HgC3, HgD3	40–60	>6	0–8	Light silty clay loam
			8–17	Silty clay loam
			17–43	Silty clay to clay
			43	Limestone.
Haymond: Hm	>72	>6	0–48	Silt loam
			48–80	Stratified silt loam, loam, and sandy loam
Henshaw: HnA	>120	1–3	0–13	Silt loam
			13–38	Silty clay loam
			38–50	Silt loam and silty clay loam
			50–64	Silt loam
Huntington: Hu	>120	>6	0–90	Silt loam
Johnsburg: Jo	48–96	1–3	0–24	Silt loam
			24–36	Light silty clay loam
			36–72	Silt loam
			72–90	Silt loam
			90	Weathered shale.

significant to engineering

which may have different properties applicable to engineering. For this reason the reader should follow carefully the instructions

Classification—Con.		Percentage passing sieve [1]—			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
Unified	AASHO	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
					In/hr	*In/in of soil*	*pH*		
ML	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	5.6–6.5	High	Low.
CL	A–6	100	90–100	70–90	0.63–2.0	0.18–0.23	5.1–5.5	Moderate to high	Moderate.
ML or CL	A–4 or A–6	100	90–100	70–90	0.63–2.0	0.18–0.23	5.6–6.5	Moderate to high	Low.
ML or CL	A–4	100	90–100	70–90	0.63–2.0	0.18–0.20	4.5–7.3	High	Low.
ML or CL	A–4 or A–6	100	90–100	70–90	<0.06	0.06–0.08	4.5–5.0	Moderate	Low.
ML or CL	A–4 or A–6	100	90–100	70–90	0.20–0.63	0.06–0.08	4.5–5.0	Moderate	Low.
GM or ML	A–2 or A–4	55–65	50–60	25–55	0.63–2.0	0.14–0.18	4.5–6.5	Low	Low.
GM	A–2	35–45	30–40	25–35	0.63–2.0	0.09–0.11	4.5–5.0	Low	Low.
ML	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	6.1–7.3	Moderate to high	Low.
ML	A–4	70–80	50–70	50–65	0.63–2.0	0.14–0.18	5.6–6.5	Moderate to high	Low.
GM, SM	A–2	40–60	35–45	25–35	2.0 –6.3	0.08–0.12	5.6–6.5	Moderate	Low.
GM	A–2	40–60	35–45	25–35	2.0 –6.3	0.08–0.12	5.6–6.5	Moderate	Low.
ML or CL	A–4	100	90–100	70–90	0.63–2.0	0.14–0.18	6.6–7.3	Low	Low.
CL or CH	A–7	100	95–100	90–95	0.20–0.63	0.19–0.21	6.0–7.3	Low	Moderate.
ML or CL	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	6.1–7.3	Moderate to high	Low.
CL	A–6 or A–7	100	95–100	85–95	0.63–2.0	0.19–0.21	5.1–6.5	Low to moderate	Moderate.
CH	A–7	100	90–100	75–95	0.63–2.0	0.15–0.18	4.5–5.5	Low	Moderate.
ML	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	4.5–5.5	Moderate to high	Low.
ML	A–4	100	85–95	60–75	0.63–2.0	0.14–0.18	4.5–5.5	Moderate to high	Low.
ML	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	5.1–7.3	Moderate	Low.
CL	A–6	100	90–100	70–90	0.63–2.0	0.18–0.23	4.5–5.5	Moderate	Low.
ML	A–4	100	90–100	65–75	0.63–2.0	0.18–0.23	4.5–5.5	Moderate	Low.
ML	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	4.5–6.0	Moderate	Low.
CL	A–6	100	95–100	85–95	0.63–2.0	0.19–0.21	4.5–5.0	Moderate	Low to moderate.
ML or CL	A–4	100	90–100	70–95	0.63–2.0	0.18–0.23	6.1–7.3	Moderate to high	Low.
CL	A–6 or A–7	85–100	85–100	80–95	0.63–2.0	0.19–0.21	5.1–7.3	Moderate	Moderate.
CH	A–7	95–100	90–100	75–95	0.63–2.0	0.15–0.18	4.5–5.5	Moderate	Moderate.
ML	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	6.1–7.3	Moderate to high	Low.
ML or SM	A–4	100	85–95	45–65	0.63–2.0	0.14–0.18	6.1–6.5	Low	Low.
ML or CL	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	6.1–7.3	High	Low.
CL	A–6	100	95–100	85–95	0.20–0.63	0.19–0.21	4.5–6.0	High	Moderate.
ML or CL	A–6	100	90–100	75–95	0.20–0.63	0.18–0.23	6.6–7.3	Moderate	Moderate.
ML	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	([2])	Moderate	Low.
ML or CL	A–4	100	90–100	70–90	0.63–2.0	0.18–0.23	6.5–7.3	Moderate	Low.
ML or CL	A–4 or A–6	100	90–100	70–95	0.63–2.0	0.18–0.23	4.5–6.5	High	Low.
CL	A–6	100	95–100	85–100	<0.06	0.06–0.08	4.5–5.5	High	Low to moderate.
ML or CL	A–4 or A–6	100	90–100	70–100	<0.06	0.06–0.08	4.5–5.5	Moderate	Low to moderate.
ML or CL	A–4 or A–6	100	90–100	70–90	0.63–2.0	0.06–0.08	4.5–5.5	Moderate	Low to moderate.

TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Depth to— Bedrock	Depth to— Seasonal high water table	Depth from surface	Classification: USDA texture
	In	*Ft*	*In*	
Markland: MaD2, MaF, McC3, McD3	>120	>6	0–8	Silt loam
			8–13	Silty clay loam
			13–29	Silty clay
			29–60	Stratified silt loam and silty clay
Pekin:[3] PeB	>120	3–6	0–31	Silt loam
			31–76	Silt loam
			76–82	Silt loam
Quarries: Qu. No valid estimates can be made.				
Tilsit:[3] TlA, TlB2	48–84	3–6	0–11	Silt loam
			11–29	Silty clay loam
			29–46	Silt loam
			46–57	Silt loam to loam
			57	Sandstone and shale.
Wakeland: Wa	>72	1–3	0–23	Silt loam
			23–60	Silt loam
Weikert. Mapped only in a complex with Berks and Gilpin soils.	8–20	>6	0–15	Channery silt loam
			15	Sandstone.
Wellston: WeC2, WeC3, WeD2, WeD3	36–60	>6	0–13	Silt loam
			13–37	Silty clay loam
			37–47	Silty clay loam
			47–52	Weathered sandstone and shale
			52	Sandstone and shale.
Wheeling: WhA, WhB2, WhC2, WhE2	>120	>6	0–17	Loam
			17–35	Light silty clay loam
			35–67	Silt loam
			67–87	Stratified silt loam, loam, and sand
Zanesville:[3] ZaC2, ZaC3	48–84	>6	0–24	Silt loam
			24–44	Silt loam
			44–76	Silty clay
			67	Shale.

[1] The percentage passing through sieves is rounded to the nearest 5 percent.
[2] Calcareous.

Tests for liquid limit and plastic limit measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil is increased from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes, if disturbed, from a plastic state to a liquid state. The *plastic limit* is the moisture content at which the soil material changes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the material changes, if disturbed, from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Soil properties significant to engineering

Table 6 provides estimates of several soil properties that are important in engineering. These estimates are based on test data shown in table 5, on field observations made in the course of mapping, and on experience with the same kinds of soil in other counties. These estimates should not be considered a substitute for detailed examination at the specific site proposed for construction.

The information in table 6 applies to a depth of 5 feet or less. Generally, only the major horizons are described, but special horizons are described if they have engineering properties that are significantly different from adjacent horizons. Following are explanations of some of the columns in table 6.

significant to engineering—Continued

Classification—Con.		Percentage passing sieve[1]—			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
Unified	AASHO	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
					In/hr	*In/in of soil*	*pH*		
ML or CL	A-4 or A-6	100	90–100	70–90	0.63–2.0	0.18–0.23	6.6–7.3	High	Low to moderate.
CL	A-7	100	95–100	85–95	0.63–2.0	0.19–0.21	6.6–7.3	Moderate	Moderate.
CH	A-7	100	95–100	90–95	0.06–0.20	0.15–0.18	6.6–7.3	Moderate	High.
CL or CH	A-6 or A-7	100	90–100	70–90	0.06–0.20	0.15–0.18	([2])	Moderate	Moderate to high.
ML or CL	A-4 or A-6	100	90–100	70–90	0.63–2.0	0.18–0.20	4.5–6.5	High	Low.
ML or CL	A-4 or A-6	100	90–100	70–90	<0.06	0.06–0.08	4.5–5.0	Moderate	Low.
ML	A-4	100	90–100	70–90	0.63–2.0	0.06–0.08	4.5–5.0	Moderate	Low.
ML	A-4	100	90–100	70–90	0.63–2.0	0.18–0.23	5.1–6.5	High	Low.
CL	A-6	100	95–100	85–95	0.63–2.0	0.16–0.18	4 5–5.0	High	Low.
ML or CL	A-4 or A-6	100	90–100	70–90	<0.06	0.06–0.08	4.5–5.0	Moderate	Low.
ML	A-4	100	90–100	70–90	0.63–2.0	0.06–0.08	4.5–5.0	Moderate	Low.
ML	A-4	100	90–100	70–90	0.63–2.0	0.18–0.23	6.1–7.3	High	Low.
ML	A-4	100	90–100	70–90	0.63–2.0	0.18–0.23	6.1–7.3	High	Low.
GM	A-2	45–55	30–50	25–35	2.0 -6.3	0.12–0.14	4.5–6.5	Low	Low.
ML	A-4	100	90–100	70–90	0.63–2.0	0.18–0.23	5.1–6.5	High	Low.
CL	A-6	100	95–100	85–95	0.63–2.0	0.19–0.21	4.6–5.5	Moderate to high	Moderate.
ML or CL	A-4 or A-6	100	90–100	70–90	0.63–2.0	0.18–0.23	4.6–5.5	Moderate	Low to moderate.
CL	A-6	85–95	80–90	70–80	0.63–2.0	0.18–0.23	4.6–5.5	Moderate	Low to moderate.
ML	A-4	100	85–95	60–75	0.63–2.0	0.14–0.18	5.1–6.5	Moderate	Low.
CL	A-6	100	95–100	85–95	0.63–2.0	0.19–0.21	4.5–5.0	Moderate	Moderate.
ML or CL	A-4 or A-6	100	90–100	70–90	0.63–2.0	0.18–0.23	4.5–5.0	Moderate	Low.
ML or SM	A-4 or A-2	100	90–100	30–60	0.63–2.0	0.18–0.23	4.5–5.0	Moderate	Low.
ML	A-4	100	90–100	70–100	0.63–2.0	0.18–0.21	5.1–6.5	High	Low.
ML or CL	A-4 or A-6	100	90–100	70–100	<0.06	0.06–0.08	4.5–5.5	Moderate	Low.
CL or CH	A-6 or A-7	100	95–100	90–95	0.06–0.20	0.06–0.08	4.5–5.5	Moderate	Moderate.

[3] A fragipan restricts percolation, and the soil above the pan becomes saturated during wet seasons.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the layer of rock.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years, generally in spring. Estimates apply to soils that have not been drained artificially.

Soil texture is described in table 6 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," and "clay" and some other terms used in USDA textural classification are defined in the Glossary of this survey.

Permeability is that quality of a saturated soil that enables it to transmit water and air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates do not take into account lateral seepage or such transient soil features as plowpans and surface crusts. These estimated values should not be confused with the coefficient "k" of permeability used by engineers.

TABLE 7.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is
reason the reader should follow carefully the instruction

Soil series and map symbols	Suitability as a source of—		Soil features affecting—	
	Topsoil	Road fill	Highway location	Dikes, levees, and pond embankments
Alford: AfB2, AfE2	Good	Poor in subsoil and substratum: low to moderate shrink-swell potential; medium to high compressibility; fair to poor shear strength; subject to frost heave.	Subject to frost heave; cuts and fills needed; highly erodible where exposed on embankments.	Subsoil and substratum: fair stability and compaction; low to moderate compacted permeability; medium to high compressibility; fair resistance to piping; low to moderate shrink-swell potential; poor to fair shear strength.
Bartle: Ba	Fair: low in content of organic matter; seasonal high water table.	Fair to poor in subsoil and substratum: fair stability and compaction; medium to high compressibility; subject to frost heave.	Seasonal high water table; subject to frost heave; fair stability; fragipan.	Subsoil and substratum: fair stability and compaction; low to moderate compacted permeability; medium to high compressibility; fair resistance to piping; poor to fair shear strength.
*Berks: BgF For Gilpin and Weikert parts, see their respective series.	Poor: high in content of channery material.	Good in subsoil and substratum.	Bedrock at depth of 20 to 36 inches; cuts and fills needed.	Subsoil and substratum: fair stability; fair to good compaction; moderate compacted permeability; slight compressibility; fair resistance to piping; good shear strength.
Burnside: Bu	Good	Good in subsoil and substratum.	Subject to flooding and to frost heave.	Subsoil and substratum: fair stability; fair to good compaction; moderate compacted permeability; slight compressibility; fair resistance to piping; good shear strength.
Corydon: CoF	Poor: shallow to bedrock.	Not suitable: bedrock at depth of 10 to 20 inches.	Bedrock at depth of 10 to 20 inches; cuts and fills needed.	Bedrock at depth of 10 to 20 inches.
Crider: CrB2, CrC2	Good	Poor in subsoil and substratum: fair stability and compaction; medium to high compressibility; moderate shrink-swell potential; fair to poor shear strength.	Subject to frost heave; cuts and fills needed; highly erodible where exposed on embankments.	Subsoil and substratum: fair stability and compaction; low compacted permeability; medium to high compressibility; poor resistance to piping; fair to poor shear strength.
Cuba: Cu	Good: subject to flooding.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; poor shear strength; subject to frost heave.	Subject to flooding and to frost heave.	Subsoil and substratum: fair stability and compaction; low compacted permeability; medium to high compressibility; poor resistance to piping; poor shear strength.
Elkinsville: ElB2, ElC2.	Good	Fair to poor in subsoil and substratum: fair to poor stability and compaction; medium to high compressibility; subject to frost heave; fair to poor shear strength.	Cuts and fills needed; highly erodible where exposed on embankments; subject to frost heave.	Subsoil and substratum: fair to poor stability; medium to high compressibility; fair resistance to piping; fair to poor shear strength; moderate to low compacted permeability; fair to poor compaction.

engineering properties of the soils

made up of two or more kinds of soil, which may have different interpretations. For this for referring to other series in the first column of this table]

Soil features affecting—Continued					Limitations for septic tank filter fields
Pond reservoir areas	Agricultural drainage	Terraces and diversions [1]	Grassed waterways	Foundations for low buildings	
Moderate permeability.	Not applicable	Features generally favorable.	Features generally favorable.	Medium to high compressibility; shear strength fair in subsoil but poor in substratum.	Slight where slopes are 2 to 6 percent. Severe where slopes are 12 to 25 percent.
Nearly level; very slowly permeable fragipan; seasonal high water table.	Seasonal high water table; very slow permeability; fragipan.	Not applicable	Not applicable	Seasonal high water table; medium to high compressibility; fair to poor shear strength.	Severe: very slow permeability; seasonal high water table.
Moderate permeability; bedrock at depth of 20 to 36 inches.	Not applicable	Not applicable	Not applicable	Bedrock at depth of 20 to 36 inches; slight compressibility; good shear strength.	Severe: bedrock at depth of 20 to 36 inches.
Moderate permeability; subject to flooding.	Not applicable	Not applicable	Not applicable	Subject to flooding; slight compressibility; good shear strength.	Severe: subject to flooding.
Bedrock at depth of 10 to 20 inches.	Not applicable	Not applicable	Not applicable	Bedrock at depth of 10 to 20 inches; moderate to high compressibility; moderate shrink-swell potential.	Severe: bedrock at depth of 10 to 20 inches.
Subject to seepage in underlying limestone bedrock.	Not applicable	Features generally favorable.	Features generally favorable.	Fair to poor shear strength; moderate shrink-swell potential; medium to high compressibility.	Slight where slopes are 2 to 6 percent: possible contamination of underground water through fractured limestone bedrock. Moderate where slopes are 6 to 12 percent: possible contamination of underground water through fractured limestone bedrock.
Nearly level; moderate permeability; subject to flooding; moderate seepage rate.	Not applicable	Not applicable	Not applicable	Subject to flooding; poor stability; medium compressibility.	Severe: subject to flooding.
Moderate permeability.	Not applicable	Features generally favorable.	Features generally favorable.	Fair to poor shear strength; low shrink-swell potential; medium to high compressibility.	Slight where slopes are 2 to 6 percent. Moderate where slopes are 0 to 12 percent.

TABLE 7.—*Interpretations of*

Soil series and map symbols	Suitability as a source— Topsoil	Road fill	Soil features affecting— Highway location	Dikes, levees, and pond embankments
*Gilpin: GlE2, GlE3, GpE. For Berks part of GpE, see Berks series.	Good	Fair in subsoil: fair stability and compaction; medium compressibility; fair shear strength; bedrock at depth of 20 to 36 inches.	Bedrock at depth of 20 to 36 inches; cuts and fills needed.	Subsoil: fair stability and compaction; low to moderate compacted permeability; medium compressibility; fair to poor resistance to piping; fair shear strength; bedrock at depth of 20 to 36 inches.
Gullied land: Gu. Not interpreted; material variable.				
Hagerstown: HaD2, HaE2, HgC3, HgD3.	Fair to good: eroded areas somewhat clayey.	Poor in subsoil and substratum: fair to poor stability and compaction; medium to high compressibility; moderate shrink-swell potential; poor shear strength.	Cuts and fills needed; material plastic; bedrock at depth of 3 to 5 feet.	Subsoil and substratum: fair to poor stability and compaction; low compacted permeability; medium to high compressibility; good resistance to piping; poor shear strength.
Haymond: Hm	Good: subject to flooding.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; fair shear strength; subject to frost heave.	Subject to flooding and to frost heave.	Subsoil and substratum: poor stability and compaction; moderate compacted permeability; medium compressibility; poor resistance to piping; fair shear strength.
Henshaw: HnA	Good	Poor in subsoil and substratum: fair to poor stability and compaction; medium compressibility; fair to poor shear strength; subject to frost heave.	Seasonal high water table; subject to frost heave.	Subsoil and substratum: fair to poor stability and compaction; low to moderate compacted permeability; fair to good resistance to piping; fair to poor shear strength, medium compressibility.
Huntington: Hu	Good: subject to flooding.	Fair in subsoil and substratum: fair stability and compaction; medium compressibility; fair to poor shear strength; subject to frost heave.	Subject to flooding and to frost heave.	Subsoil and substratum: fair stability and compaction; low to moderate compacted permeability; medium compressibility; poor resistance to piping; fair to poor shear strength.
Johnsburg: Jo	Fair to good: seasonal high water table.	Fair to poor in subsoil and substratum: fair stability and compaction; medium compressibility; fair shear strength; subject to frost heave.	Seasonal high water table; subject to frost heave; fair stability; fragipan.	Subsoil and substratum: fair stability and compaction; low compacted permeability; medium compressibility; fair resistance to piping; fair shear strength.
Markland: MaD2, MaF, McC3, McD3.	Fair: somewhat clayey.	Poor in subsoil and substratum: fair to poor stability and compaction; high compressibility; moderate to high shrink-swell potential; poor shear strength; highly plastic.	Cuts and fills needed; material plastic; moderate to high shrink-swell potential.	Subsoil and substratum: fair to poor stability and compaction; low compacted permeability; high compressibility; good resistance to piping; moderate to high shrink-swell potential; poor shear strength.

engineering properties of the soils—Continued

Soil features affecting—Continued					Limitations for septic tank filter fields
Pond reservoir areas	Agricultural drainage	Terraces and diversions [1]	Grassed waterways	Foundations for low buildings	
Moderate permeability; bedrock at depth of 20 to 36 inches.	Not applicable	Not applicable	Not applicable	Bedrock at depth of 20 to 36 inches; medium compressibility; fair shear strength.	Severe: bedrock at depth of 20 to 36 inches.
Subject to seepage in underlying limestone bedrock, which is at depth of 3 to 5 feet.	Not applicable	Clayey material in subsoil; difficult to establish vegetation.	Clayey material in subsoil; difficult to establish vegetation.	Poor shear strength; medium to high compressibility; bedrock at depth of 3 to 5 feet; moderate shrink-swell potential.	Moderate where slopes are 6 to 12 percent: possible contamination of underground water through fractured limestone bedrock. Severe where slopes are 12 percent: possible contamination of underground water through fractured limestone bedrock.
Nearly level; moderate permeability; subject to flooding.	Not applicable	Not applicable	Not applicable	Subject to flooding; poor stability; medium compressibility; fair shear strength.	Severe: subject to flooding.
Nearly level; seasonal high water table; moderate seepage rate in substratum.	Seasonal high water table.	Not applicable	Not applicable	Seasonal high water table; medium compressibility; fair to poor shear strength; fair to poor stability.	Severe: moderately slow permeability; seasonal high water table.
Nearly level; moderate permeability; subject to flooding.	Not applicable	Not applicable	Not applicable	Subject to flooding; medium compressibility; fair to poor shear strength.	Severe: subject to flooding.
Nearly level; seasonal high water table.	Very slow permeability: seasonal high water table fragipan.	Not applicable	Not applicable	Seasonal high water table; medium compressibility; fair shear strength; fair stability.	Severe: very slow permeability.
Features generally favorable.	Not applicable	Clayey subsoil; difficult to establish vegetation.	Clayey subsoil; difficult to establish vegetation.	Poor shear strength; moderate to high shrink-swell potential; high compressibility.	Severe: slow permeability.

TABLE 7.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—	
	Topsoil	Road fill	Highway location	Dikes, levees, and pond embankments
Pekin: PeB	Fair: low in content of organic matter.	Fair to poor in subsoil and substratum: fair stability and compaction; medium compressibility; fair to poor shear strength; subject to frost heave.	Subject to frost heave; fragipan.	Subsoil and substratum: fair stability and compaction; low to moderate compacted permeability; fair resistance to piping; fair to poor shear strength; medium compressibility.
Quarries: Qu. Not interpreted; material variable.				
Tilsit: TlA, TlB2	Good	Fair to poor in subsoil and substratum: fair stability and compaction; medium compressibility; fair to poor shear strength.	Cuts and fills needed; subject to frost heave; fragipan.	Subsoil and substratum: fair stability and compaction; low to moderate compacted permeability; medium compressibility; good to poor resistance to piping; fair to poor shear strength.
Wakeland: Wa	Good: subject to flooding.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; fair to poor shear strength; subject to frost heave.	Subject to flooding and to frost heave.	Subsoil and substratum: poor stability and compaction; moderate compacted permeability; medium compressibility; poor resistance to piping; fair to poor shear strength.
Weikert Mapped only in a complex with Berks and Gilpin soils.	Poor: shallow to bedrock.	Not suitable: bedrock at depth of 8 to 20 inches.	Bedrock at depth of 8 to 20 inches; cuts and fills needed.	Bedrock at depth of 8 to 20 inches
Wellston: WeC2, WeC3, WeD2, WeD3.	Good	Poor in subsoil and substratum: fair stability and compaction; medium compressibility; fair to poor shear strength.	Cuts and fills needed; subject to frost heave; bedrock at depth rock at depth of 4 to 7 feet.	Subsoil and substratum: fair stability and compaction; low to moderate compacted permeability; medium compressibility; fair resistance to piping; low to moderate shrink-swell potential; fair to poor shear strength.
Wheeling: WhA, WhB2, WhC2, WhE2.	Good	Fair to good in subsoil and substratum: fair stability and compaction; medium compressibility; fair shear strength.	Cuts and fills needed; erodible on embankments.	Subsoil and substratum: fair stability and compaction; moderate compacted permeability; medium compressibility; fair resistance to piping; fair shear strength.
Zanesville: ZaC2, ZaC3.	Good	Poor in subsoil and substratum: fair stability and compaction; medium to high compressibility; fair to poor shear strength.	Cuts and fills needed; subject to frost heave; fragipan; bed- of 4 to 7 feet.	Subsoil and substratum: fair stability and compaction; low compacted permeability; medium to high compressibility; fair resistance to piping; fair to poor shear strength.

Available water capacity is the approximate amount of capillary water in the soil when the soil is wet to field capacity. The capacity of a particular horizon to deliver water to plant roots depends on whether the roots can reach that horizon. The available water capacity of soils that have a fragipan is computed to the average depth to the pan. Since the area immediately above the pan tends to serve as a reservoir for water in excess of field capacity, however, this is considered in computing the total available water capacity.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values.

Frost potential includes heave caused by ice lenses that form in the soil and the subsequent loss of strength

engineering properties of the soils—Continued

Soil features affecting—Continued					Limitations for septic tank filter fields
Pond reservoir areas	Agricultural drainage	Terraces and diversions [1]	Grassed waterways	Foundations for low buildings	
Nearly level; moderate to slow seepage rate in substratum.	Not applicable	Very slowly permeable fragipan at depth of about 24 inches; difficult to establish vegetation.	Very slowly permeable fragipan at depth of about 24 inches; difficult to establish vegetation.	Fair to poor shear strength: medium compressibility.	Severe: very slow permeability.
Moderate seepage rate in substratum.	Not applicable	Very slowly permeable fragipan at depth of about 24 inches; difficult to establish vegetation.	Very slowly permeable fragipan at depth of about 24 inches; difficult to establish vegetation.	Fair to poor shear strength; medium compressibility.	Severe: very slow permeability.
Nearly level; moderate permeability; subject to flooding.	Seasonal high water table; subject to flooding.	Not applicable	Not applicable	Subject to flooding; fair to poor shear strength; medium compressibility; seasonal high water table.	Severe: subject to flooding.
Bedrock at depth of 8 to 20 inches.	Not applicable	Not applicable	Not applicable	Bedrock at depth of 8 to 20 inches.	Severe: bedrock at depth of 8 to 20 inches.
Moderate seepage rate; bedrock at depth of 3 to 5 feet.	Not applicable	Bedrock at depth of 3 to 5 feet.	Bedrock at depth of 3 to 5 feet.	Fair to poor shear strength; medium compressibility; bedrock at depth of 3 to 5 feet.	Moderate where slopes are 6 to 12 percent: bedrock at depth of 3 to 5 feet. Severe where slopes are 12 to 18 percent: bedrock at depth of 3 to 5 feet.
Moderate to rapid seepage rate in substratum.	Not applicable	Features generally favorable.	Features generally favorable.	Fair shear strength; medium compressibility.	Slight where slopes are 0 to 6 percent. Moderate where slopes are 6 to 12 percent. Severe where slopes are 12 to 25 percent.
Bedrock at depth of 4 to 7 feet.	Not applicable	Very slowly permeable fragipan at depth of about 24 inches; difficult to establish vegetation.	Very slowly permeable fragipan at depth of about 24 inches; difficult to establish vegetation.	Fair to poor shear strength; medium compressibility.	Severe: very slow permeability.

[1] Terraces and diversions are not suited to slopes of more than 12 percent.

resulting from excess moisture during periods of thaw. Frost action is a hazard only if the soil is susceptible, if there is a source of water while the soil temperature is below the freezing point, and if freezing temperature continues long enough for the soil to freeze.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foun-

dations, roads, and other structures. A high shrink-swell potential indicates a hazard of maintenance of structures built in, on, or of material having this rating.

Engineering interpretations of soils

The estimated interpretations in table 7 are based on the engineering properties of soils shown in table 6, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Crawford County. In table 7 ratings are used to summarize limitation or suitability of the soils for topsoil, road fill, and septic tank filter fields. For all other uses, table 7 lists those soil features not to be overlooked in planning, installation, and maintenance. The data apply to the soil considered representative of the series. A profile that is representative of each series is described in the section "Descriptions of the Soils."

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties generally are favorable for the rated use or that soil limitations are minor and are easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation and special designs are needed.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe. Following are explanations of some of the columns in table 7.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Highway location pertains to superhighways similar to those of the interstate system and not to local roads and streets. Factors considered in selecting location of such highways are soil features that can affect design, construction, and performance.

Dikes, levees, and embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Agricultural drainage is affected by such features as permeability, texture, and structure of the soil; depth to restricting layers that influence rate of water movement; depth to water table; slope; stability of ditchbanks; and availability of outlets for the drainage system.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Grassed waterways are natural or constructed waterways, generally broad and shallow, covered by erosion-resistant grasses, used to conduct surface water from areas of cropland. Features considered important are those that affect the establishment, growth, and maintenance of vegetation and those that affect layout and construction.

Foundations for low buildings are affected by features that relate to capacity to support a load and to resist settlement under a load, and those that relate to ease of excavation. Soil properties that affect capacity to support a load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 and 72 inches is evaluated. The soil properties considered are those that affect both absorption of the effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table and to rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Use of the Soils for Recreation

The landscape and natural resources of Crawford County, as well as the location of the county in relation to large centers of population, favor development of income-producing enterprises based on recreation. Shooting preserves and areas for hunting, sites for camping and picnicking, and areas for fishing and other aquatic sports would attract many to the county. The development of watersheds could result in the creation of lakes and reservoirs suitable for many uses, including recreation.

The Harrison-Crawford State Forest and the Wyandotte Cave are examples of recreational facilities that already have been developed. In addition, some areas of well-drained soils on uplands are well suited to use for picnicking and intensive play areas, and they can also be used as sites for tents and trailers and for the location of cottages and utility buildings. The Ohio

River offers opportunities for boating, swimming, and water skiing.

In table 8 the soils of Crawford County are rated according to their limitations for six stated recreational uses. The ratings are based on soil features, and they generally do not take into account other factors that may be important in selecting an area for the purpose stated. The ratings for cottages and utility buildings do not take into consideration suitability of the soils for septic tank filter fields, because ratings for septic tank filter fields are given in the section "Engineering Uses of the Soils."

A rating of *slight* means that the recreational facility is easily created, improved, or maintained. A rating of *moderate* means that the facility generally can be created, improved, or maintained but that moderate soil limitations affect design and management. A rating of *severe* means that feasibility of establishing the facility on the specified soil is questionable, that extreme measures are needed to overcome the limitation, and that limitations are severe enough to make the facility impractical at the intended location. Where the rating is *moderate* or *severe,* the limiting soil feature is indicated.

Formation and Classification of the Soils

This section discusses the major factors of soil formation as they relate to the soils of Crawford County. It also describes the processes of soil formation, explains the system of classifying soils into higher categories, and places the soil series in some categories of the current system.

Factors of Soil Formation

The characteristics of a soil are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the parent material has been in place and subject to the soil-forming processes.

Climate and vegetation are the active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in some cases, determines it almost entirely. Finally, time is needed for changing parent material into a soil. Usually, a long period of time is needed for distinct horizons to develop.

Few generalizations can be made regarding the effect of any one factor of soil formation, because the effect of each is modified by the other four. Many of the processes of soil development are unknown.

Parent material

The parent material from which many of the soils of Crawford County are derived was weathered from sandstone, limestone, siltstone, or shale. The parent material of the rest of the soils consists of lacustrine deposits of Wisconsin age and of deposits of loess.

Bedrock in this county dips in a west-southwest direction at a rate of about 25 feet per mile. Scope of this structural dip is regional. Bedrock is nearest the surface in the east-central part of Indiana and is at the greatest depth in the extreme southwestern part of the State. The bedrock at or near the surface consists of sedimentary rock and is of Middle Mississippian, Late Mississippian, and Early Pennsylvanian age.

Formations of Middle Mississippian age, along the eastern edge of the county, consist of limestone. They are the formations in which most of the quarries are located. Soils of the Hagerstown and Crider series formed in material weathered mainly from limestone. Formations of Late Mississippian age, throughout the central part of the county, consist of bedded shale, sandstone, siltstone, and limestone. Thin layers of limestone crop out at the surface throughout areas underlain by these formations. Formations of Early Pennsylvanian age, in the western part of the county, include thick-bedded and thin-bedded sandstone, and they also include shale. Within these formations of sandstone and shale are thin layers of coal. Soils of the Wellston and Gilpin series formed in material weathered mainly from sandstone and shale.

Some of the soils are on nearly level terraces, or benches, along the Ohio River and along tributary streams throughout the county. These terraces are above areas of bottom lands. They developed during periods of glaciation in the Pleistocene epoch. Elkinsville and Bartle soils formed on low, weakly developed terraces in the northern part of the county; Markland and Henshaw soils formed on lacustrine terraces along tributary streams in the southern part of the county; and Wheeling soils formed in stream-deposited sand and gravel on terraces along the Ohio River. All of these terraces developed directly or indirectly as the result of an increase in the size of the Ohio River. This increase was caused by the melting of the continental glaciers to the north, in the basin of the Ohio River.

TABLE 8.—*Limitations of soils for recreational uses*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which may have different interpretations. For this reason the reader should follow carefully the instructions for referring to other series in the first column of this table]

Soil series and map symbols	Cottages and utility buildings	Campsites for tents and trailers	Parks, picnic areas, and intensive play areas	Playgrounds, athletic fields, and intensive play areas	Paths and trails	Golf course fairways
Alford: AfB2	Slight	Slight	Slight	Moderate: slopes of 2 to 6 percent.	Slight	Slight.
AfE2	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Moderate: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.
Bartle: Ba	Moderate: somewhat poorly drained; seasonal high water table.	Severe: somewhat poorly drained; seasonal high water table; very slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained; seasonal high water table; wet and soft after rains.	Severe: somewhat poorly drained; seasonal high water table; very slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained; seasonal high water table; wet and soft after rains.	Moderate: somewhat poorly drained; seasonal high water table; wet and soft after rains.
*Berks: BqF For Gilpin and Weikert parts, see their respective series.	Severe: steep slopes; bedrock at depth of 20 to 36 inches.	Severe: steep slopes; bedrock at depth of 20 to 36 inches.	Severe: steep slopes; bedrock at depth of 20 to 36 inches.	Severe: steep slopes; bedrock at depth of 20 to 36 inches.	Moderate where slopes are 18 to 25 percent. Severe where slopes are 25 to 45 percent.	Severe: steep slopes; bedrock at depth of 20 to 36 inches.
Burnside: Bu	Severe: subject to flooding.	Severe: subject to flooding	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Corydon: CoF	Severe: slopes of 20 to 60 percent; bedrock at depth of less than 20 inches.	Severe: slopes of 20 to 60 percent; bedrock at depth of less than 20 inches.	Severe: slopes of 20 to 60 percent; bedrock at depth of less than 20 inches.	Severe: slopes of 20 to 60 percent; bedrock at depth of less than 20 inches.	Severe: slopes of 20 to 60 percent; bedrock at depth of less than 20 inches.	Severe: slopes of 20 to 60 percent; bedrock at depth of less than 20 inches.
Crider: CrB2	Slight	Slight	Slight	Moderate: slopes of 2 to 6 percent.	Slight	Slight.
CrC2	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Severe: slopes of 6 to 12 percent.	Slight	Moderate: slopes of 6 to 12 percent.
Cuba: Cu	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Elkinsville: ElB2	Slight	Slight	Slight	Moderate: slopes of 2 to 6 percent.	Slight	Slight.

TABLE 8.—*Limitations of soils for recreational uses*—Continued

Soil series and may symbols	Cottages and utility buildings	Campsites for tents and trailers	Parks, picnic areas, and intensive play areas	Playgrounds, athletic fields, and intensive play areas	Paths and trails	Golf course fairways
ElC2	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Severe: slopes of 6 to 12 percent.	Slight	Moderate: slopes of 6 to 12 percent.
*Gilpin: GlE2, GlE3, GpE. For Berks part of GpE, see Berks series.	Severe: slopes of 18 to 35 percent; bedrock at depth of 20 to 36 inches.	Severe: slopes of 18 to 35 percent; bedrock at depth of 20 to 36 inches.	Severe: slopes of 18 to 35 percent; bedrock at depth of 20 to 36 inches.	Severe: slopes of 18 to 35 percent; bedrock at depth of 20 to 36 inches.	Moderate where slopes are 18 to 25 percent. Severe where slopes are 25 to 35 percent.	Severe: slopes of 18 to 35 percent; bedrock at depth of 20 to 36 inches.
Gullied land: Gu. Material too variable for valid ratings.						
Hagerstown:						
HgC3	Moderate: slopes of 6 to 12 percent; bedrock at depth of 36 to 60 inches.	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Severe: slopes of 6 to 12 percent.	Slight	Moderate: slopes of 6 to 12 percent.
HaD2, HaE2, HgD3	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Moderate: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.
Haymond: Hm	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Henshaw: HnA	Moderate: somewhat poorly drained; seasonal high water table.	Moderate: somewhat poorly drained; seasonal high water table; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; seasonal high water table.	Moderate: somewhat poorly drained; seasonal high water table.
Huntington: Hu	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Johnsburg: Jo	Moderate: somewhat poorly drained; seasonal high water table.	Severe: somewhat poorly drained; very slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained; seasonal high water table.	Moderate: somewhat poorly drained; seasonal high water table.
Markland:						
McC3	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent; slow permeability.	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent; slow permeability.	Slight	Moderate: slopes of 6 to 12 percent.

TABLE 8.—*Limitations of soils for recreational uses*—Continued

Soil series and map symbols	Cottages and utility buildings	Campsites for tents and trailers	Parks, picnic areas, and intensive play areas	Playgrounds, athletic fields, and intensive play areas	Paths and trails	Golf course fairways
MaD2, McD3	Severe: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.	Moderate: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.
MaF	Severe: slopes of 18 to 70 percent.	Severe: slopes of 18 to 70 percent.	Severe: slopes of 18 to 70 percent.	Severe: slopes of 18 to 70 percent.	Severe: slopes of 18 to 70 percent.	Severe: slopes of 18 to 70 percent.
Pekin: PeB	Slight	Severe: very slow permeability; wet and soft after rains.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight	Slight.
Quarries: Qu. Material too variable for valid ratings.						
Tilsit: TIA, TIB2	Slight	Severe: very slow permeability; wet and soft after rains.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight	Slight.
Wakeland: Wa	Severe: somewhat poorly drained; subject to flooding.	Severe: somewhat poorly drained; subject to flooding.	Moderate: somewhat poorly drained; subject to flooding.	Severe: somewhat poorly drained; subject to flooding.	Moderate: somewhat poorly drained; subject to flooding.	Moderate: somewhat poorly drained; subject to flooding.
Weikert. Mapped only in a complex with Berks and Gilpin soils.	Severe: steep slopes; bedrock at depth of less than 20 inches.	Severe: steep slopes; bedrock at depth of less than 20 inches.	Severe: steep slopes; bedrock at depth of less than 20 inches.	Severe: steep slopes; bedrock at depth of less than 20 inches.	Severe: steep slopes; bedrock at depth of less than 20 inches.	Severe: steep slopes; bedrock at depth of less than 20 inches.
Wellston: WeC2, WeC3	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Severe: slopes of 6 to 12 percent.	Slight	Moderate: slopes of 6 to 12 percent.
WeD2, WeD3	Severe: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.	Moderate: slopes of 12 to 18 percent.	Severe: slopes of 12 to 18 percent.
Wheeling: WhA	Slight	Slight	Slight	Slight	Slight	Slight.
WhB2	Slight	Slight	Slight	Moderate where slopes are 2 to 6 percent.	Slight	Slight.
WhC2	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.	Severe: slopes of 6 to 12 percent.	Slight: slopes of 6 to 12 percent.	Moderate: slopes of 6 to 12 percent.
WhE2	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.	Severe: slopes of 12 to 25 percent.

TABLE 8.—*Limitations of soils for recreational uses*—Continued

Soil series and map symbols	Cottages and utility buildings	Campsites for tents and trailers	Parks, picnic areas, and intensive play areas	Playgrounds, athletic fields, and intensive play areas	Paths and trails	Golf course fairways
Zanesville: ZaC2, ZaC3	Moderate: slopes of 6 to 12 percent.	Severe: slopes of 6 to 12 percent; very slow permeability; wet and soft after rains.	Moderate: slopes of 6 to 12 percent.	Severe: slopes of 6 to 12 percent; very slow permeability; wet and soft after rains.	Slight	Moderate: slopes of 6 to 12 percent.

TABLE 9.—*Classification of the soil series*

Series	Family	Subgroup	Order
Alford	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Bartle	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Burnside [1]	Loamy-skeletal, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Corydon	Clayey, mixed, mesic	Lithic Argiudolls	Mollisols.
Crider	Fine-silty, mixed, mesic	Typic Paleudalfs	Alfisols.
Cuba	Fine-silty, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Elkinsville	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Hagerstown	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Haymond	Coarse-silty, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Henshaw	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols.
Huntington	Fine-silty, mixed, mesic	Fluventic Hapludolls	Mollisols.
Johnsburg	Fine-silty, mixed, mesic	Aquic Fragiudults	Ultisols.
Markland	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Pekin	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Tilsit	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols.
Wakeland	Coarse-silty, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols.
Weikert	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols.
Wheeling	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Zanesville	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.

[1] Less acid than is typical for the series.

During the Peorian Stage of the Pleistocene Epoch, a mantle of loess was deposited in what is now Crawford County. Near the Ohio River this mantle is as much as 10 feet thick, but it is thinner in the rest of the county. On ridgetops the mantle of loess is mostly only about 2 to 4 feet thick. Zanesville and Tilsit soils formed in a thin mantle of loess over material weathered from sandstone and shale.

Climate

Crawford County has a midcontinental climate that is characterized by a wide range in temperature from summer to winter. In July the average daily maximum temperature is about 90° F, and in January the average daily minimum temperature is about 22°. The climate is nearly uniform throughout the county. Therefore, differences among the soils cannot be attributed to differences in climate.

The average annual rainfall is 43.8 inches. Rainfall is well distributed throughout the year, but slightly more rainfall is received in spring and summer than in fall and winter. The abundant rainfall has leached plant nutrients from the surface layer and has prevented free calcium carbonate from accumulating.

Climatic forces act directly upon rocks and weather them to form the parent material from which soils are formed. Many of the more important soil characteristics are the result, however, of the influence of climate

on living organisms. Without the changes brought about by the action of plants and animals, the soils would generally consist only of residual material or of transported material derived from weathered rock, though some might have definite layers caused by additions of alluvial or of colluvial material or by differential weathering or leaching.

Climate, acting alone on parent material, would be largely destructive, because rain and melting snow would wash the soluble material out of the soils. The processes of climate become constructive only when combined with the activities of plants and animals. Plants draw nutrients from the lower part of the soil. Then, when the plants die, the nutrients are restored to the soil, in varying degrees, by the accumulation of decaying vegetation in the upper part of the soil profile. In Crawford County the climate is such that leaching progresses faster than plant nutrients are replaced. This accounts for the fact that most of the soils are strongly weathered and are leached, acid, and low in fertility.

Plant and animal life

Higher plants, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to the formation of soils. The higher plants bring moisture and plant nutrients from the lower part of the profile to the upper part, and they return organic matter to the soil. Bacteria and fungi decomposed dead vegetation, and the organic matter from this vegetation is incorporated into the soil.

The native vegetation in this county was mainly hardwood trees, which return a comparatively small amount of organic matter to the soils. In uncleared areas in the uplands, the surface is covered with a thin layer of forest litter and leaf mold, and the topmost 1 or 2 inches of soil material contains a small amount of organic matter. Berks and Weikert are examples of soils that formed under hardwood trees.

Vegetation is fairly uniform throughout the county. Major differences among the soils, therefore, cannot be explained on the basis of differences in vegetation. Some comparatively minor variations in the vegetation are associated with different soils, but these variations are probably a result and not the cause of differences among the soils.

Relief

Relief influences the formation of soils through its effect on drainage, runoff, leaching, and normal and accelerated erosion. In this county relief ranges from nearly level on bottom lands, terraces, and upland flats to very steep on breaks. Most of the county has been well dissected by weathering and stream cutting. The lowest place in the county, where the Ohio River leaves the county just west of Alton, is 363 feet above sea level. The highest point, about 4.5 miles northeast of English, is 953 feet above sea level.

Steep soils have a less well developed profile than level or sloping soils. Their weaker profile development results from more rapid geologic erosion, less leaching, and lack of sufficient soil moisture to support a vigorous growth of plants.

Examples of soils that show the effects of variations in relief on the development of soils that formed in the same kind of parent material are those of the Zanesville-Johnsburg-Tilsit catena. All of the soils in this catena formed in a mantle of loess over sandstone or material weathered from shale. All are very slowly permeable. The Zanesville soils, which are moderately sloping, are well drained and are brown or dark brown. The Johnsburg soils, which are nearly level, are somewhat poorly drained, and are gray and mottled. The Tilsit soils, which are nearly level or gently sloping, are moderately well drained and are yellowish brown. They have some mottling in the subsoil.

Time

Significant differences among the soils of Crawford County result from differences in the length of time the parent material has undergone the processes of soil formation. A mature soil is one that has well-developed A and B horizons produced by the natural processes of soil formation. An immature soil is one that has little or no horizon differentiation. Generally, the longer the processes of soil formation have taken place, the greater will be the degree of horizon differentiation. The effect of time, however, is modified by relief and by the nature of the parent material. Steep topography and a parent material that is extremely resistant to weathering retard the development of horizons.

Most of the soils on the smoother parts of the uplands and on the older stream terraces are mature. The soils on first bottoms and those that formed in local alluvium and colluvium are immature because the parent material is young and new material is deposited periodically. Steep soils are also likely to be immature because geologic erosion removes soil material almost as fast as it accumulates. They are also likely to be immature because more water is lost through runoff and less is percolated through the soil than is percolated through mature soils.

The oldest soils in Crawford County are those that formed in residuum weathered from sandstone, shale, siltstone, and limestone. The soils that formed in lacustrine material—those of the Markland and Henshaw series—are less deeply and thoroughly leached than such soils as the Crider and Zanesville that formed in residual material. The young soils, for example those of the Corydon and Weikert series, are shallow over bedrock and generally have such steep slopes that erosion nearly keeps pace with soil formation. They formed in residual material. Other young soils are those that formed on bottom lands, where fresh material is deposited periodically. Examples of those soils are the Huntington and Haymond.

Processes of Soil Formation

Several processes were involved in the formation of the soils of Crawford County. These processes are the accumulation of organic matter; the solution, transfer, and reprecipitation of calcium carbonate and bases; the liberation, reduction, and transfer of iron; and the formation and translocation of silicate clay minerals.

In most soils more than one of these processes have been active in the differentiation of horizons.

The accumulation of organic matter in the upper part of the profile is important in the formation of an A1 horizon. Generally, soils that contain much organic matter have a thick, dark-colored surface layer.

Carbonates and bases have been leached from the upper horizons of nearly all of the soils of this county. This leaching is generally believed to precede the translocation of silicate clay minerals.

Clay particles accumulate in pores and form films on surfaces along which water moves. Leaching of bases and the translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. In soils of the Zanesville series, translocated silicate clays, in the form of clay films, have accumulated in the B2t horizon.

The reduction and transfer of iron, called gleying, is evident in some of the somewhat poorly drained soils, as for example, those of the Bartle series. The gray color of the subsoil indicates the reduction and loss of iron. The mottles in some horizons indicate segregation of iron.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 *(2)* and was revised later *(6)*. The system currently used by the National Cooperative Soil Survey was developed in the early sixties *(5)* and was adopted in 1965 *(8)*. It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 9 shows the classification of each soil series in Crawford County by family, subgroup, and order, according to the current system.

ORDERS.—Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. Five of these orders are represented in Crawford County. They are Inceptisols, Mollisols, Alfisols, Ultisols, and Entisols.

SUBORDERS.—Each order is divided into suborders, primarily on the basis of characteristics that seem to produce classes having genetic similarity. These are mainly characteristics that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The climatic range is narrower than that of the orders.

GREAT GROUPS.—Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major horizons and similarity of the significant features of corresponding horizons. The horizons considered are those in which clay, iron, or humus have accumulated and those that have a pan that interferes with the growth of roots or the movement of water. The features selected are the self-mulching properties of clays, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

SUBGROUPS.—Each group is divided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order.

FAMILIES.—Families are established within a subgroup primarily on the basis of properties that affect the growth of plants or the behavior of soils in engineering use. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—The series is a group of soils having major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. New soil series are established and concepts of some of the established series, especially the older ones, are revised in the course of the nationwide soil survey program. A proposed series is given tentative status during the time its concepts are being studied at State, regional, and national levels of responsibility for soil classification.

General Nature of the County [4]

This part of the soil survey gives general information about Crawford County. It briefly discusses towns and villages, population, natural resources, farming, and transportation. It also gives facts about the climate.

Crawford County is in the hilly area along the Ohio River. Nine townships are in the county, and there are five small incorporated towns and 21 unincorporated towns and villages. Four of the towns have a municipal water system, and two have a public sewage system. Lines for transporting natural gas have been installed to three of the towns.

In 1970 the county had a population of 8,033. Five

[4] DONALD E. SLOAN, district conservationist, Soil Conservation Service, supplied the information for this section, except facts about climate.

school systems, four of which include a high school, are in the county, and several denominations have one or more churches. A Crawford County medical and dental clinic is located at English.

Natural resources, other than soils, are minerals, water, and timber. Limestone and sandstone are plentiful and are the principal mineral resources. There are four actively mined limestone quarries. Many small streams that are tributary to five rivers are well distributed throughout the county, and the Ohio River forms the southern boundary. Timber is an abundant and extremely important natural resource. In 1964 about 50 percent of the land area was in trees. Many small sawmills, operated throughout the county, add significantly to the total income.

Income from farming provides a fairly large part of the total income. Small family farms are dominant, and row crops, small grain, and livestock are the main farm products. In 1969, the county had a total of 543 farms.

Transportation is available by highway, rail, and water. Six Federal and State highways traverse the county, and many county roads provide access to all parts of the county. Two buslines, three trucking firms, and one freight line serve the county, and docking facilities for small boats are available on the Ohio River. The commercial airport in Louisville is about 45 miles east of the center of Crawford. Several small private or municipal airfields are located in adjoining counties.

Climate [5]

The climate of Crawford County is invigorating and is characterized by four well-defined seasons. Because tropical and polar air overlap in this area, changes in temperature and humidity are frequent. Table 10 gives facts about temperature and precipitation in this county. Table 11 gives probabilities of the last freezing temperatures in spring and the first in fall.

The average annual rainfall is 43.8 inches. In most years, rainfall is well distributed and is ample for the crops commonly grown in the county. Thunderstorms are the usual source of rainfall in summer. During these storms, the intensity of rainfall is often great enough that severe soil erosion is caused in sloping areas where the soils are not properly protected. Occasionally in summer and early in fall, little or no precipitation occurs for as much as 3 weeks. This lack of rainfall can damage crops and significantly lower yields, especially on soils that have only low or medium available water capacity.

Relative humidity on a typical day in summer ranges from the forties to 90 or higher just before dawn. During a 24-hour period, relative humidity rises and falls, much as temperature does, but the highest relative humidity usually occurs when the temperature is lowest, and the lowest relative humidity occurs when the temperature is highest. In winter, relative humidity generally ranges from the sixties to the nineties. Southerly winds bring higher humidity than northerly winds.

Prevailing winds are from the southwest during most of the year, but they are from the west and northwest in winter. Average velocity of the wind, 20 feet above the ground, is about 10 miles per hour in spring and about 7 miles per hour in summer.

According to temperature data recorded at Marengo, the length of the average growing season is 155 days on the basis of a 32° temperature, or 175 days on the

[5] By LAWRENCE A. SCHAAL, climatologist for Indiana, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature and precipitation data*

[Precipitation data from Leavenworth, 1926–67; temperature data from Marengo, 1921–67]

Month	Temperature					Precipitation			
	Average daily maximum	Average daily minimum	Average highest temperature	Average lowest temperature	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover of 1 inch or more
	°F	°F	°F	°F	In	In	In		In
January	43	22	63	−3	4.1	1.3	8.0	5	3
February	45	23	67	1	3.3	.9	6.7	4	3
March	57	32	76	14	4.8	1.6	8.7	2	4
April	67	40	85	25	4.0	1.4	6.5	0	0
May	77	50	90	35	4.4	1.1	8.2	0	0
June	85	59	95	46	4.0	1.4	7.6	0	0
July	90	62	98	51	4.1	1.5	7.5	0	0
August	88	61	97	48	3.2	1.0	5.8	0	0
September	82	54	94	37	2.9	1.0	5.7	0	0
October	71	42	86	25	2.6	.5	4.9	0	0
November	57	32	75	15	3.3	1.2	6.5	(1)	1
December	45	24	64	3	3.1	1.2	5.4	2	2
Year	67	42	100	−11	43.8	30.3	57.0	13	3

[1] Less than 0.5 day.

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data from Marengo for period 1921–67]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 29	April 13	April 24	May 9	May 25
2 years in 10 later than	March 21	April 5	April 18	May 3	May 13
5 years in 10 later than	March 10	March 20	April 9	April 23	May 2
Fall:					
1 year in 10 earlier than	November 2	October 19	October 2	September 30	September 19
2 years in 10 earlier than	November 4	November 1	October 11	October 7	September 25
5 years in 10 earlier than	November 16	November 5	October 23	October 15	October 4

basis of a 28° temperature. The growing season is long enough that most crops commonly grown in the county have time to mature.

Weather is better for outdoor activities in fall than during other parts of the year. In fall, temperatures are more often in the comfortable range than at other times, showers are fewest, and about 68 percent of the total amount of possible sunshine is received.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Catena. A sequence, or "chain," of soils on a landscape, developed from one kind of parent material but having different characteristics because of differences in relief and drainage.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Decreaser. Any of the climax range plants most heavily grazed. Because they are the most palatable, they are first to be destroyed by overgrazing.

Gleization. The reduction, translocation, and segregation of soil compounds, notably of iron, usually in the lower horizons, as a result of waterlogging with poor aeration and drainage; expressed in the soil by mottled colors dominated by gray. The soil-forming processes leading to the development of a gleyed soil.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of orangic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—the weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or by elevation of the land.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6) in diameter along the greatest dimension.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Slope. The number of feet of fall per 100 feet of horizontal distance. The classes used in this survey are—

Nearly level	0 to 2 percent	Strongly sloping	12 to 18 percent
Gently sloping	2 to 6 percent	Steep	18 to 25 percent
Moderately sloping	6 to 12 percent	Very steep	More than 25 percent

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which it belongs. A technical description of a profile that is representative of the series is discussed under the series. The capability classification system is discussed on pages 24 to 29. Information on the uses of soils for woodland and for wildlife is provided on pages 31 and 32, respectively. Other information is given in tables as follows:

Acreage and extent, table 1, page 6.
Predicted yields, table 2, page 30.
Site indexes, hazards, and preferred species by woodland suitability groups, table 3, page 34.
Suitability of soils for wildlife habitat and kinds of wildlife, table 4, page 36.
Engineering uses of the soils, tables 5, 6, and 7, pages 38 to 49.
Recreational uses of the soils, table 8, page 52.

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Woodland suitability group Symbol
AfB2	Alford silt loam, 2 to 6 percent slopes, eroded	6	IIe-3	25	1o1
AfE2	Alford silt loam, 12 to 25 percent slopes, eroded	7	VIe-1	29	1o1
Ba	Bartle silt loam	7	IIw-3	26	3w5
BgF	Berks-Gilpin-Weikert complex, 25 to 75 percent slopes	8	VIIe-2	29	3r12
Bu	Burnside silt loam	9	IIs-6	27	1o8
CoF	Corydon stony silt loam, 20 to 60 percent slopes	9	VIIe-2	29	3d7
CrB2	Crider silt loam, 2 to 6 percent slopes, eroded	10	IIe-3	25	1o1
CrC2	Crider silt loam, 6 to 12 percent slopes, eroded	10	IIIe-3	27	1o1
Cu	Cuba silt loam	10	I-2	25	1o8
ElB2	Elkinsville silt loam, 2 to 6 percent slopes, eroded	11	IIe-3	25	1o1
ElC2	Elkinsville silt loam, 6 to 12 percent slopes, eroded	11	IIIe-3	27	1o1
GlE2	Gilpin silt loam, 18 to 25 percent slopes, eroded	12	VIe-1	29	3o10
GlE3	Gilpin silt loam, 18 to 25 percent slopes, severely eroded	12	VIIe-1	29	3o10
GpE	Gilpin-Berks complex, 18 to 30 percent slopes	12	VIIe-2	29	3r12
Gu	Gullied land	12	VIIe-4	29	5r14
HaD2	Hagerstown silt loam, 12 to 18 percent slopes, eroded	13	IVe-3	28	1o1
HaE2	Hagerstown silt loam, 18 to 25 percent slopes, eroded	14	VIe-1	29	2r6
HgC3	Hagerstown silty clay loam, 6 to 12 percent slopes, severely eroded	14	IVe-3	28	1o1
HgD3	Hagerstown silty clay loam, 12 to 18 percent slopes, severely eroded	14	VIe-1	29	1o1
Hm	Haymond silt loam	14	I-2	25	1o8
HnA	Henshaw silt loam, 0 to 3 percent slopes	15	IIw-2	26	3w5
Hu	Huntington silt loam	15	I-2	25	1o8
Jo	Johnsburg silt loam	16	IIIw-3	28	3w5
MaD2	Markland silt loam, 12 to 18 percent slopes, eroded	17	VIe-1	29	3r18
MaF	Markland silt loam, 25 to 70 percent slopes	17	VIIe-1	29	3r18
McC3	Markland silty clay loam, 6 to 12 percent slopes, severely eroded	17	VIe-1	29	3r18
McD3	Markland silty clay loam, 12 to 18 percent slopes, severely eroded	17	VIIe-1	29	3r18
PeB	Pekin silt loam, 2 to 6 percent slopes	18	IIe-7	25	3d9
Qu	Quarries	18	VIIe-3	29	4r16
TlA	Tilsit silt loam, 0 to 2 percent slopes	19	IIw-5	27	3d9
TlB2	Tilsit silt loam, 2 to 6 percent slopes, eroded	19	IIe-7	25	3d9
Wa	Wakeland silt loam	20	IIw-7	27	2w13
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded	21	IIIe-3	27	3o10
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded	21	IVe-3	28	3o10
WeD2	Wellston silt loam, 12 to 18 percent slopes, eroded	21	IVe-3	28	3o10
WeD3	Wellston silt loam, 12 to 18 percent slopes, severely eroded	21	VIe-1	29	3o10
WhA	Wheeling loam, 0 to 2 percent slopes	22	I-1	25	1o1
WhB2	Wheeling loam, 2 to 6 percent slopes, eroded	22	IIe-3	25	1o1
WhC2	Wheeling loam, 6 to 12 percent slopes, eroded	22	IIIe-3	27	1o1
WhE2	Wheeling loam, 12 to 25 percent slopes, eroded	22	VIe-1	29	1r2
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded	24	IIIe-7	29	3d9
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	24	IVe-7	28	3d9

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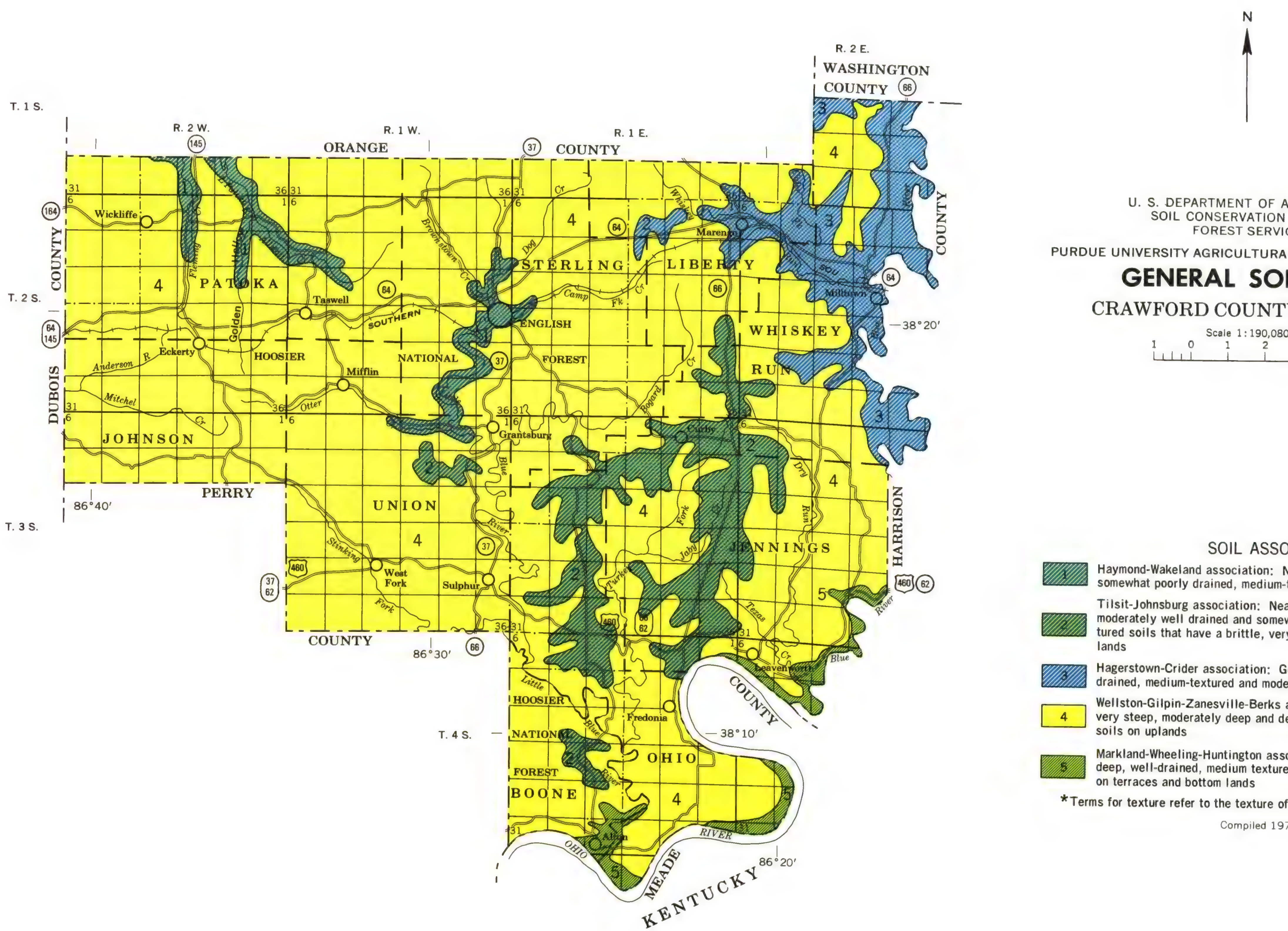


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

CRAWFORD COUNTY, INDIANA

Scale 1: 190,080

1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS*

1 Haymond-Wakeland association: Nearly level, deep, well-drained and somewhat poorly drained, medium-textured soils on bottom lands

2 Tilsit-Johnsburg association: Nearly level and gently sloping, deep, moderately well drained and somewhat poorly drained, medium-textured soils that have a brittle, very slowly permeable subsoil; on uplands

3 Hagerstown-Crider association: Gently sloping to steep, deep, well-drained, medium-textured and moderately fine textured soils on uplands

4 Wellston-Gilpin-Zanesville-Berks association: Moderately sloping to very steep, moderately deep and deep, well-drained, medium-textured soils on uplands

5 Markland-Wheeling-Huntington association: Nearly level to very steep, deep, well-drained, medium textured and moderately fine textured soils on terraces and bottom lands

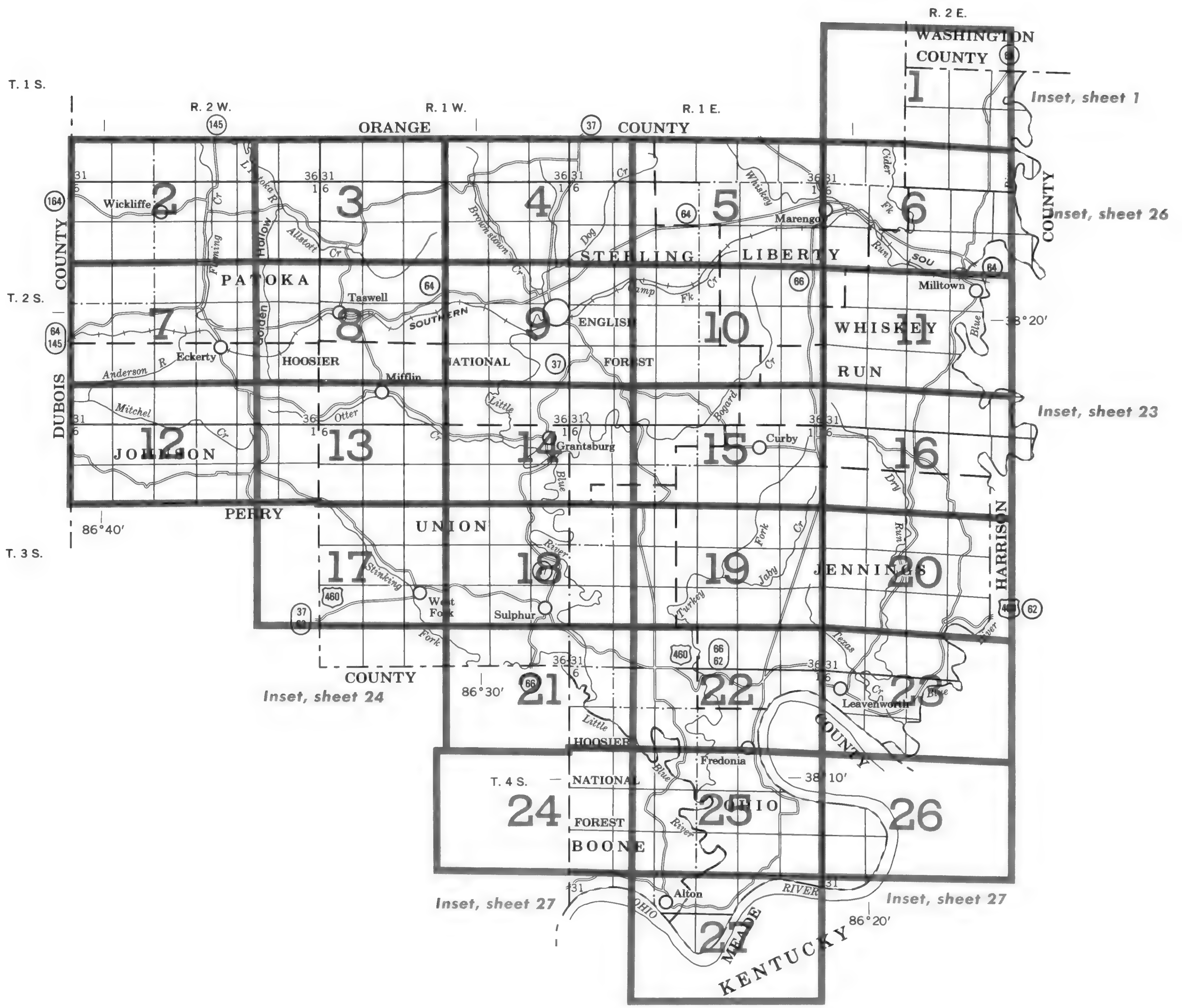
*Terms for texture refer to the texture of the surface layer of the major soils.

Compiled 1973

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



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INDEX TO MAP SHEETS
CRAWFORD COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 4 Miles

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2 or 3, in a symbol shows that the soil is eroded or severely eroded.

SYMBOL	NAME
AfB2	Alford silt loam, 2 to 6 percent slopes, eroded
AfE2	Alford silt loam, 12 to 25 percent slopes, eroded
Ba	Bartle silt loam
BgF	Berks-Gilpin-Weikert complex, 25 to 75 percent slopes
Bu	Burnside silt loam
CoF	Corydon stony silt loam, 20 to 60 percent slopes
CrB2	Crider silt loam, 2 to 6 percent slopes, eroded
CrC2	Crider silt loam, 6 to 12 percent slopes, eroded
Cu	Cuba silt loam
ElB2	Elkinsville silt loam, 2 to 6 percent slopes, eroded
ElC2	Elkinsville silt loam, 6 to 12 percent slopes, eroded
GlE2	Gilpin silt loam, 18 to 25 percent slopes, eroded
GlE3	Gilpin silt loam, 18 to 25 percent slopes, severely eroded
GpE	Gilpin-Berks complex, 18 to 30 percent slopes
Gu	Gullied land
HaD2	Hagerstown silt loam, 12 to 18 percent slopes, eroded
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HgC3	Hagerstown silty clay loam, 6 to 12 percent slopes, severely eroded
HgD3	Hagerstown silty clay loam, 12 to 18 percent slopes, severely eroded
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HnA	Henshaw silt loam, 0 to 3 percent slopes
Hu	Huntington silt loam
Jo	Johnsburg silt loam
MaD2	Markland silt loam, 12 to 18 percent slopes, eroded
MaF	Markland silt loam, 25 to 70 percent slopes
McC3	Markland silty clay loam, 6 to 12 percent slopes, severely eroded
McD3	Markland silty clay loam, 12 to 18 percent slopes, severely eroded
PeB	Pekin silt loam, 2 to 6 percent slopes
Qu	Quarries
TlA	Tilsit silt loam, 0 to 2 percent slopes
TlB2	Tilsit silt loam, 2 to 6 percent slopes, eroded
Wa	Wakeland silt loam
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded
WeD2	Wellston silt loam, 12 to 18 percent slopes, eroded
WeD3	Wellston silt loam, 12 to 18 percent slopes, severely eroded
WhA	Wheeling loam, 0 to 2 percent slopes
WhB2	Wheeling loam, 2 to 6 percent slopes, eroded
WhC2	Wheeling loam, 6 to 12 percent slopes, eroded
WhE2	Wheeling loam, 12 to 25 percent slopes, eroded
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Soil survey
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water) (w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

Reservoir maximum flood pool line

RELIEF

Escarpments
- Bedrock
- Other

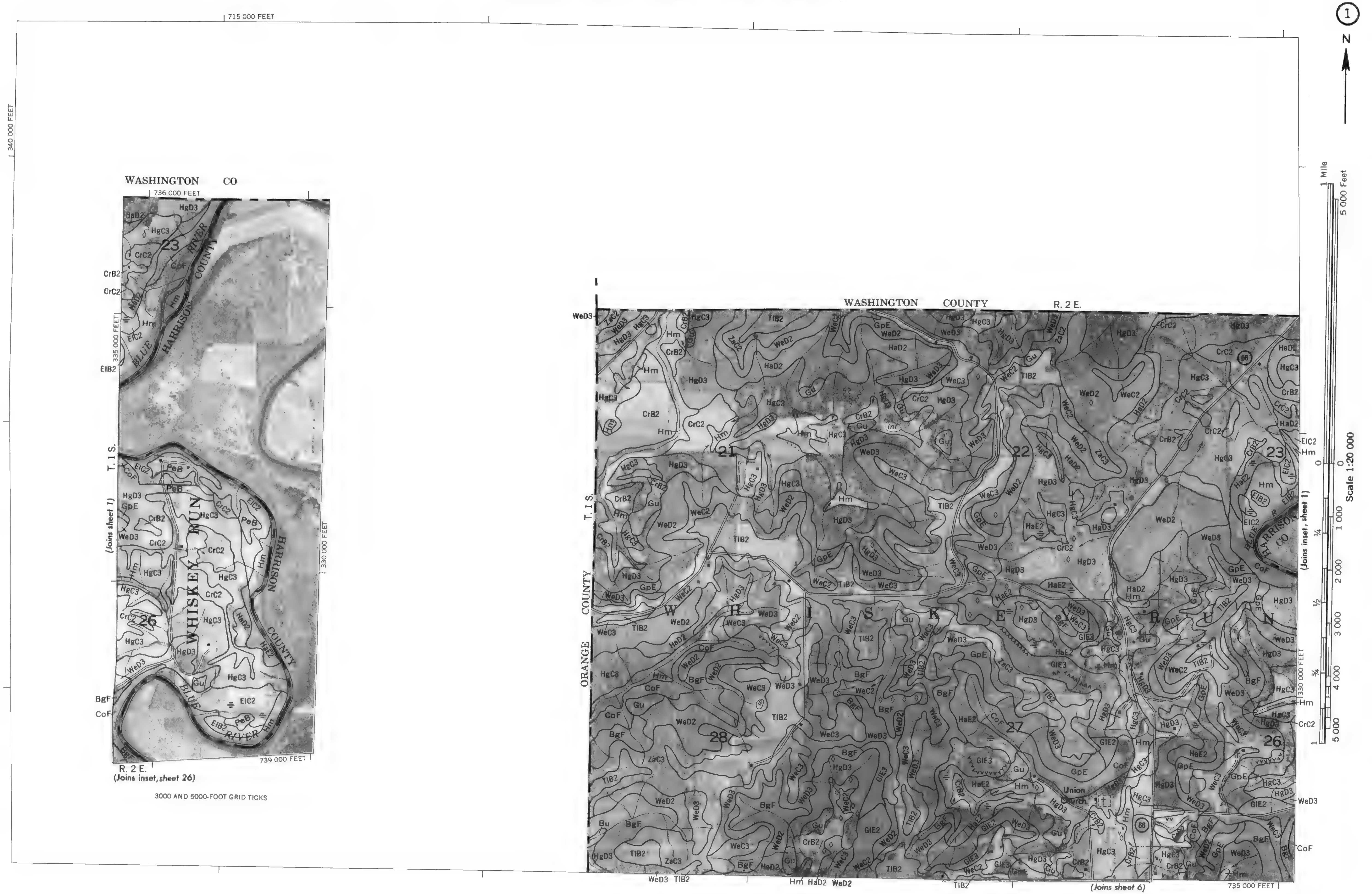
Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements

SOIL SURVEY DATA

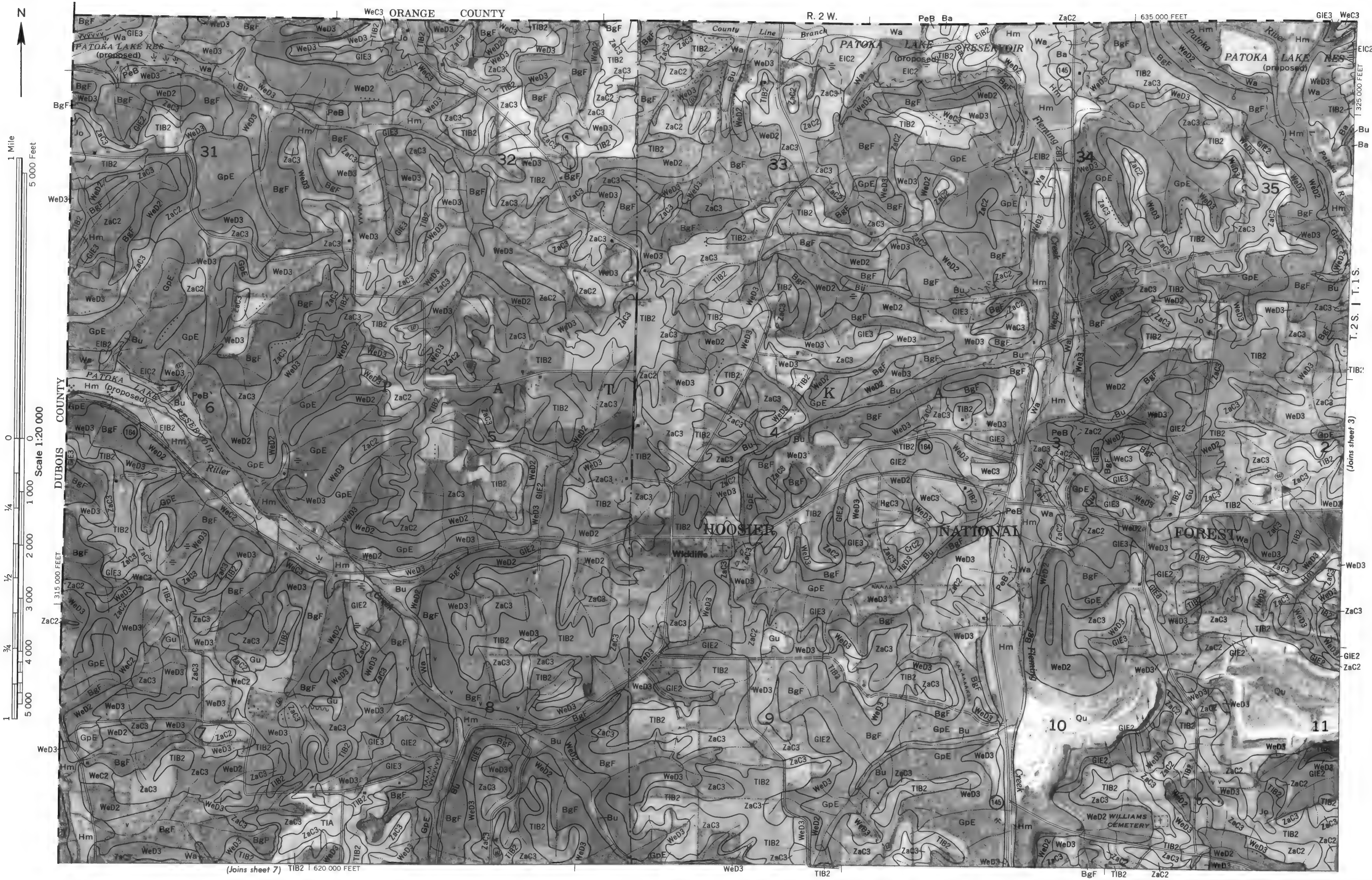
- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service and the Purdue University Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.
Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA NO. 1

CRAWFORD COUNTY, INDIANA — SHEET NUMBER 2



CRAWFORD COUNTY, INDIANA NO. 2

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CRAWFORD COUNTY, INDIANA NO. 3

CRAWFORD COUNTY, INDIANA NO. 4

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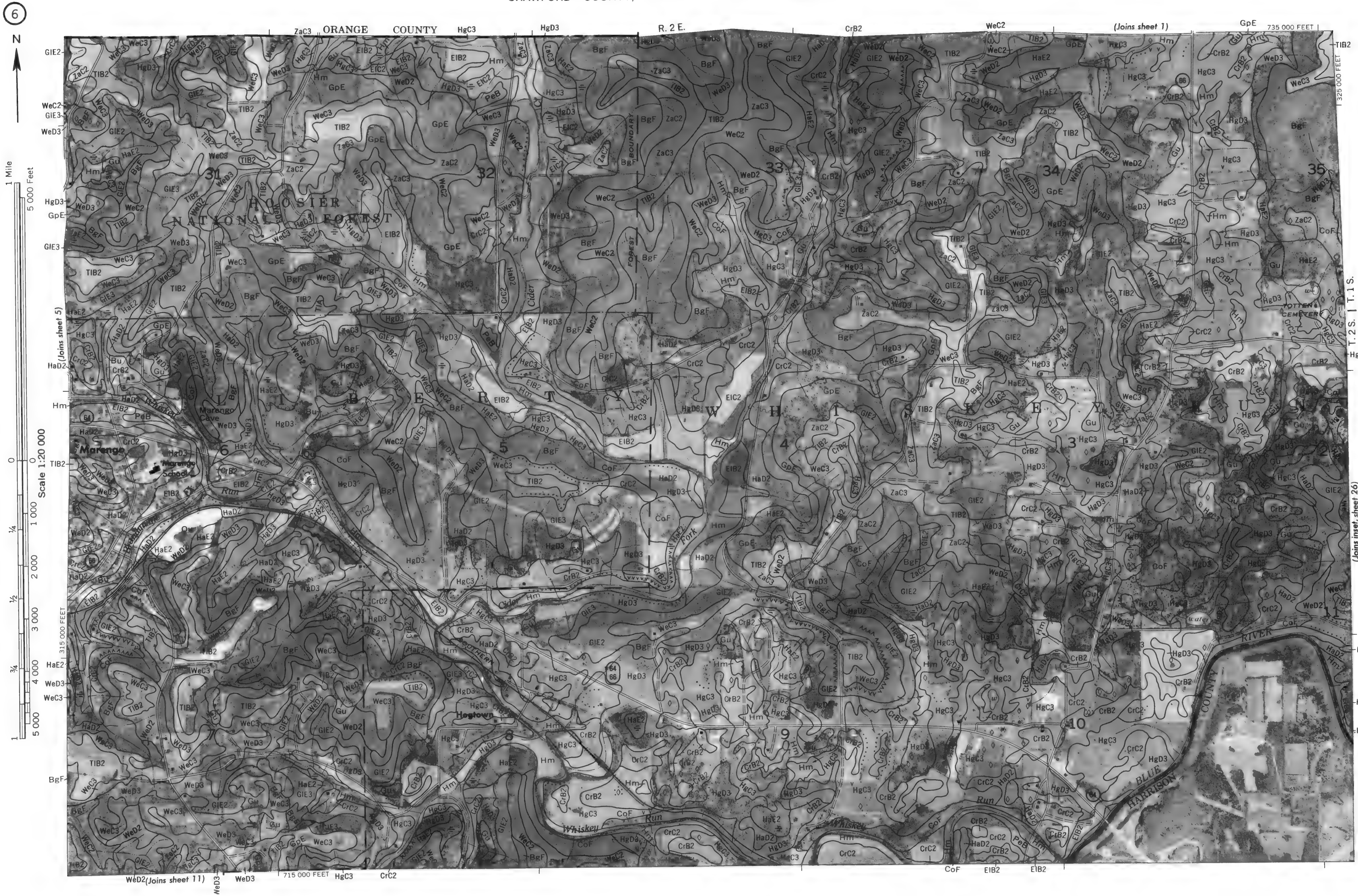
Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA NO. 5

CRAWFORD COUNTY, INDIANA — SHEET NUMBER 6



CRAWFORD COUNTY, INDIANA NO. 6

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

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7

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.
Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA NO. 7

CRAWFORD COUNTY, INDIANA — SHEET NUMBER 8

8

N

Scale 1:20 000

1 Mile ¾ ½ ¼ 0

5 000 Feet 4 000 3 000 2 000 1 000 0

CRAWFORD COUNTY, INDIANA NO. 8

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

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Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA NO. 10

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

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Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA — SHEET NUMBER 12

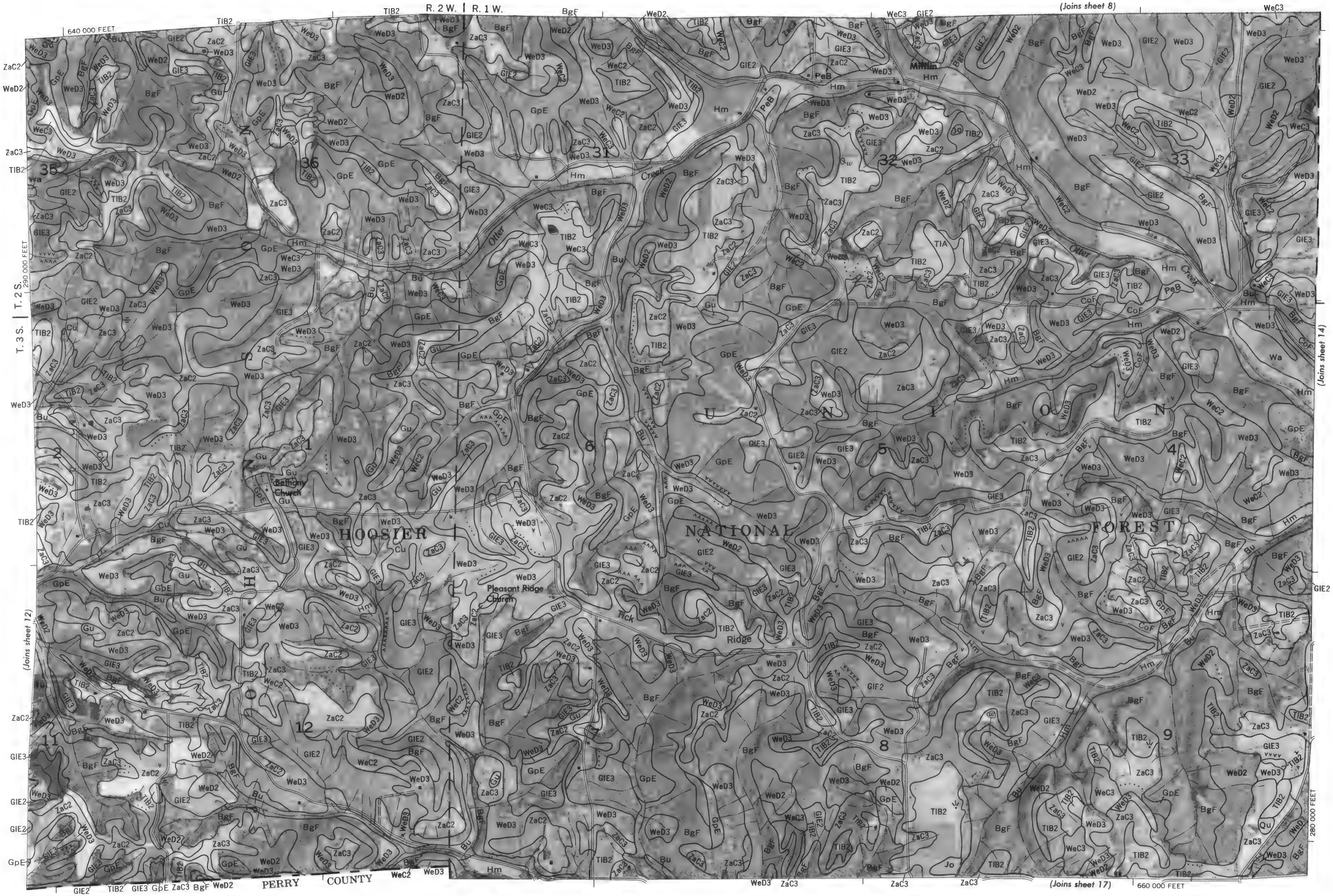
CRAWFORD COUNTY, INDIANA NO. 12

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service and the Purdue University Agricultural Experiment Station.

13



N

Scale 1:20 000

1 Mile

5 000 Feet

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

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Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA NO. 13

CRAWFORD COUNTY, INDIANA NO. 14

Land division corners are approximately positioned on this map.

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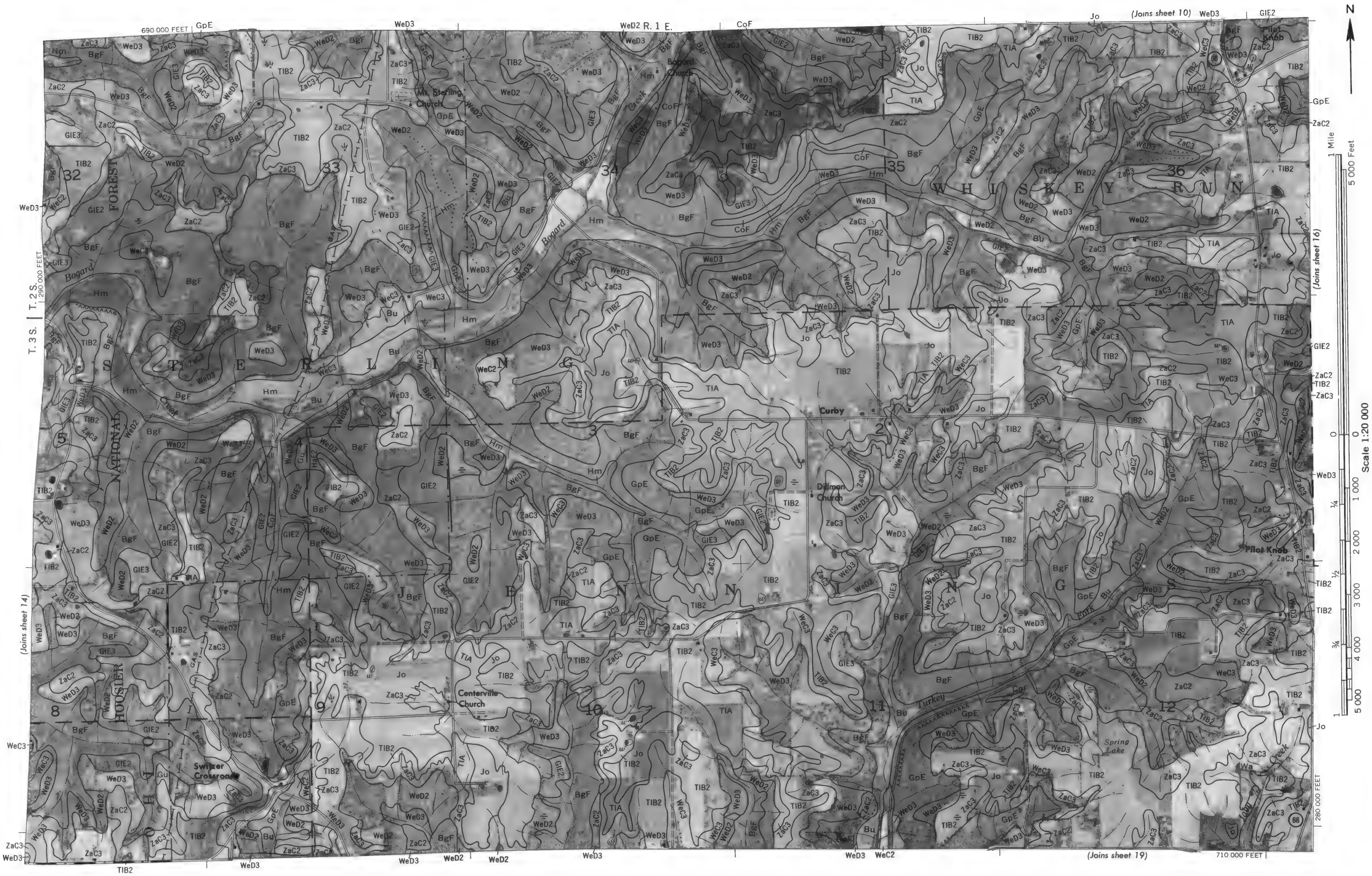
15



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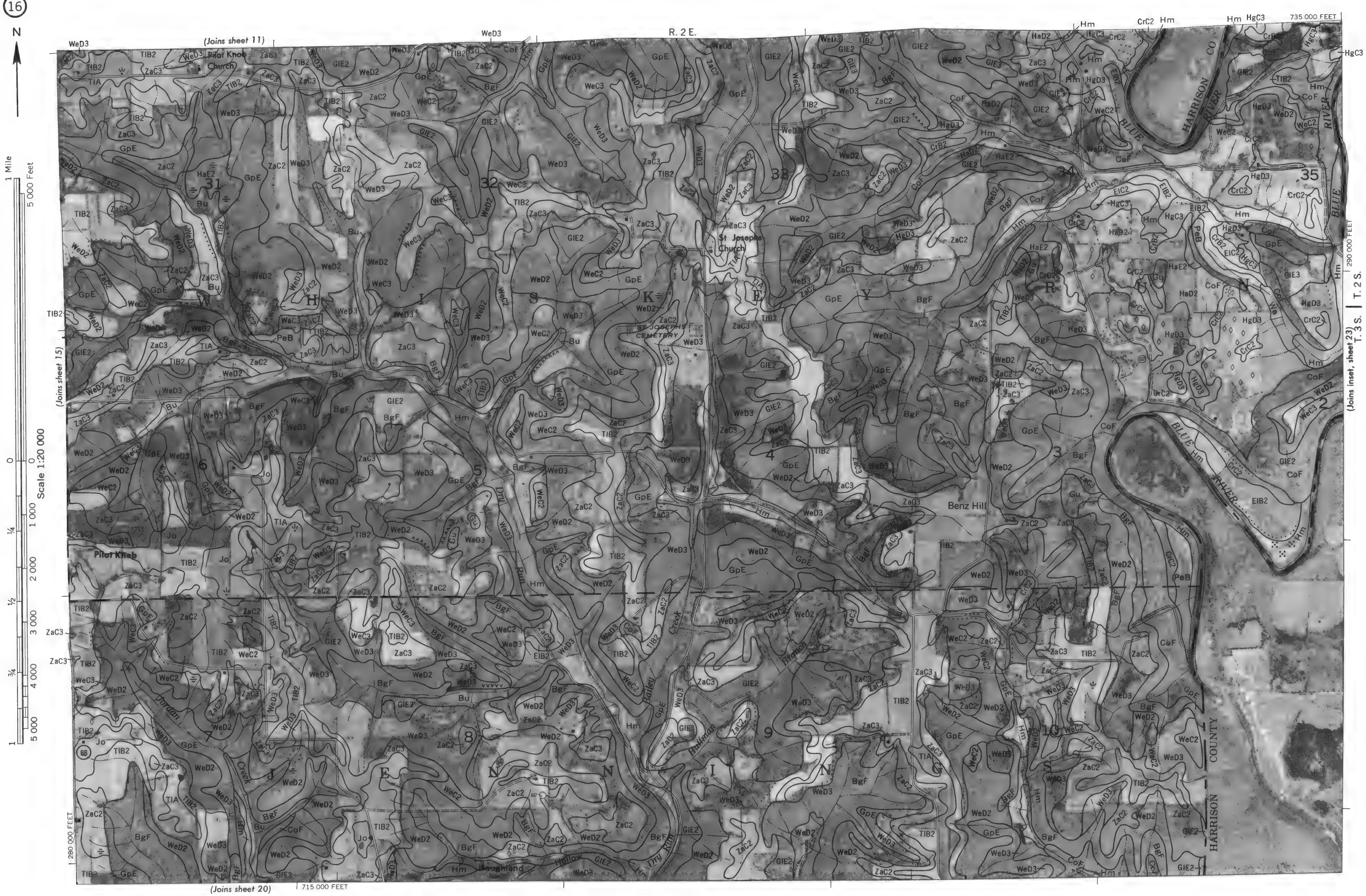
CRAWFORD COUNTY, INDIANA NO. 15

CRAWFORD COUNTY, INDIANA — SHEET NUMBER 16



CRAWFORD COUNTY, INDIANA NO. 16

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

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(17)

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.
Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA NO. 17

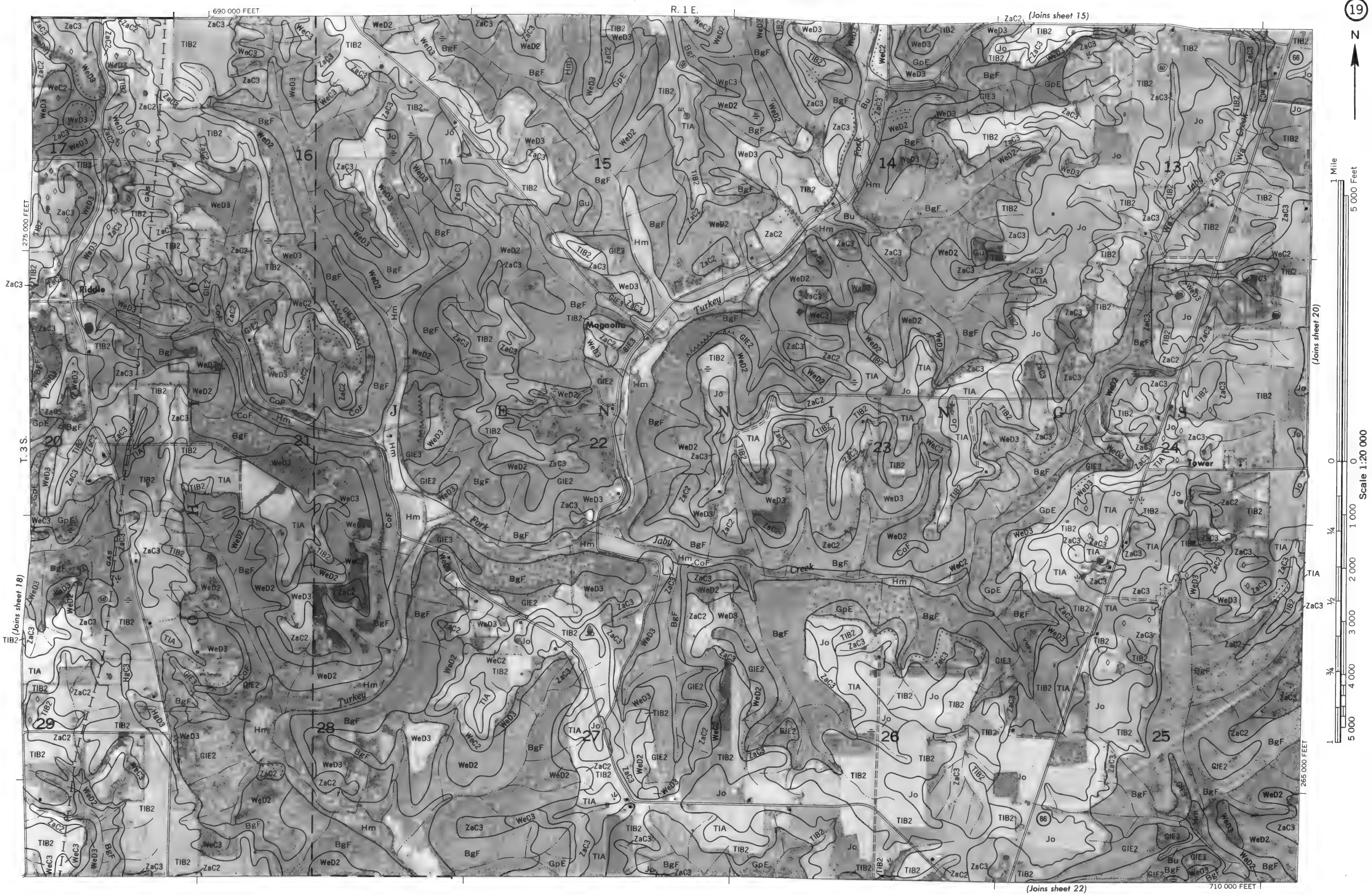
CRAWFORD COUNTY, INDIANA — SHEET NUMBER 18

CRAWFORD COUNTY, INDIANA NO. 18

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service and the Purdue University Agricultural Experiment Station.



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Land division corners are approximately positioned on this map.

20

CRAWFORD COUNTY, INDIANA 20

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

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Land division corners are approximately positioned on this map.

CRAWFORD COUNTY, INDIANA NO. 22

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

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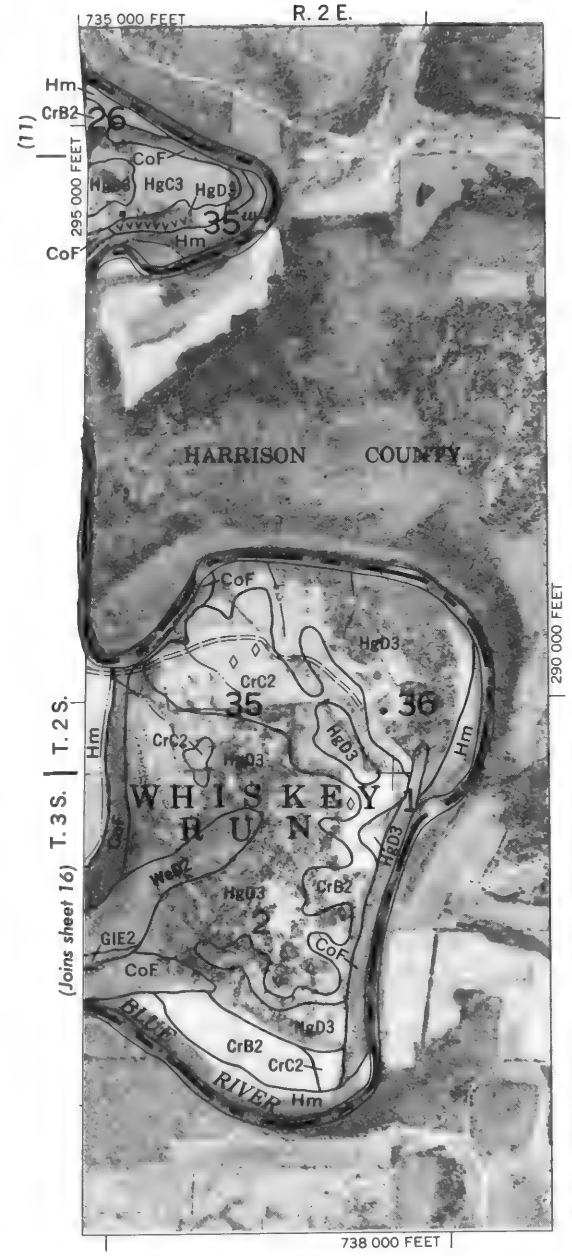
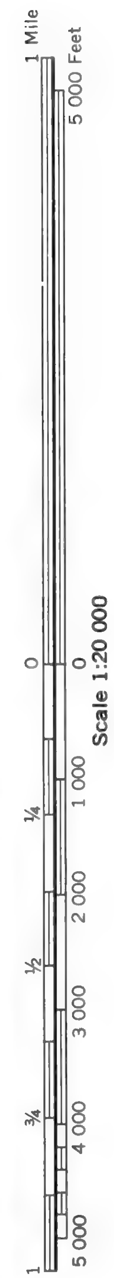
23



3000 AND 5000-FOOT GRID TICKS

N



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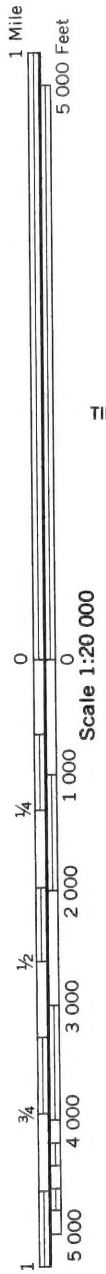
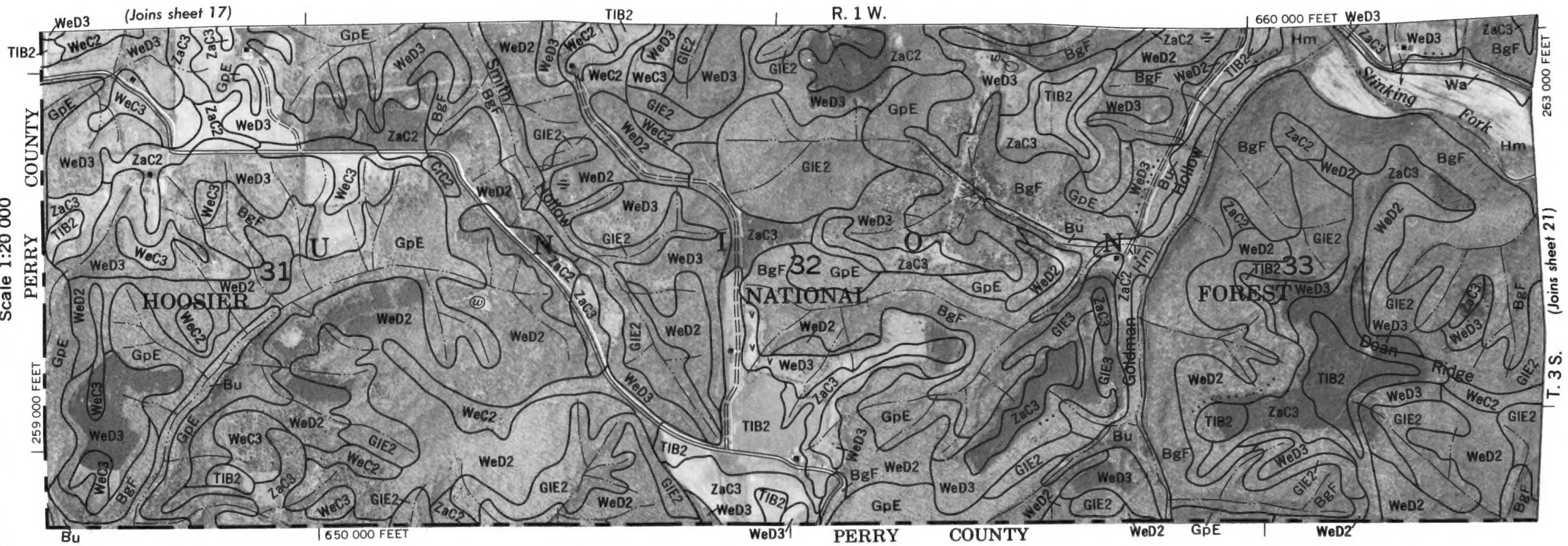
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.
Land division corners are approximately positioned on this map.
CRAWFORD COUNTY, INDIANA NO. 23

(24)

N





4000 AND 5000-FOOT GRID TICKS

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CRAWFORD COUNTY, INDIANA NO. 25

(26)

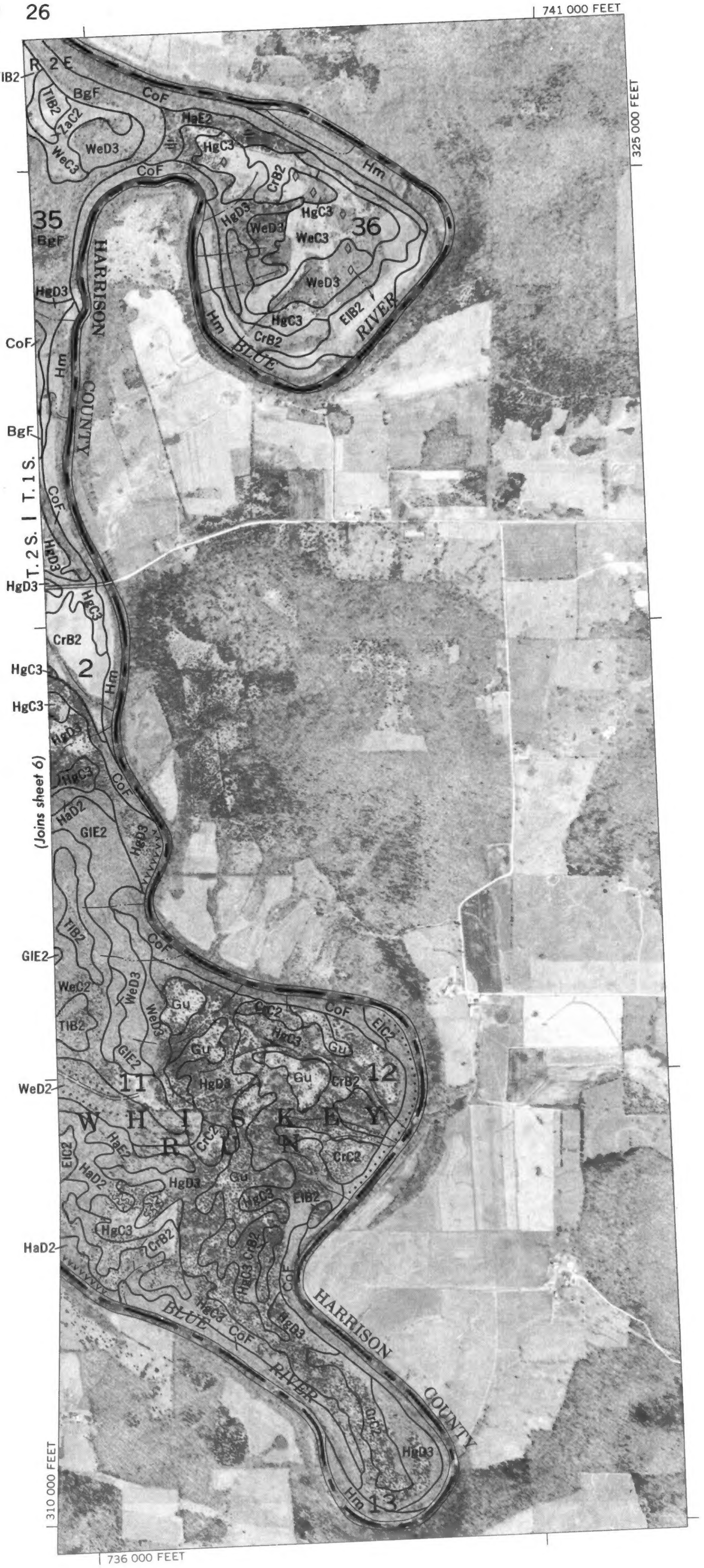
N

1 Mile | 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000



CRAWFORD COUNTY, INDIANA NO. 26

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.

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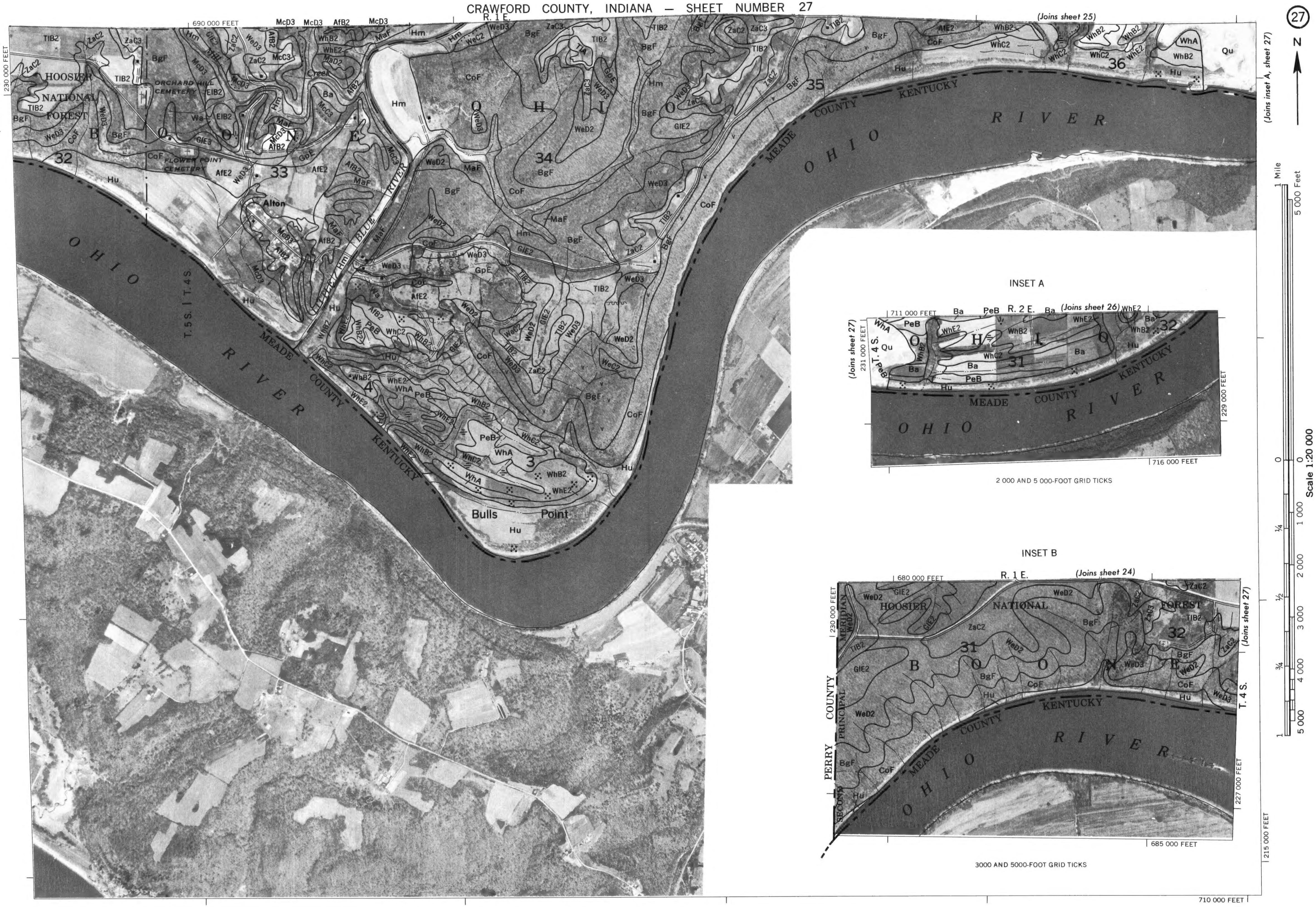

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Indiana coordinate system, west zone.
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CRAWFORD COUNTY, INDIANA NO. 27